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EDITORIAL NOTES.

A Grip on Naphthalene—Encouragement and Expectation.

RIGHTLY or wrongly, one was getting a bit tired of hearing about naphthalene—of its elusiveness and its fickleness, of the trials through which it put the gas manager, of successes in its suppression, of non-successes by the same means elsewhere, and of hopes shattered by fresh outbreaks of trouble—and the thought had often occurred that it would not be amiss if someone whose voice was respected would suggest that the subject should be eliminated from the *repertoire* of the Association Secretary until the wanderings in the wilderness of doubts bid fair to be approaching an end by the pointing out of a definite and intelligible way from the dolorous difficulty. Casting the memory over many years' intimate connection with the Association work of the gas industry, numbers of times are brought to mind when the same old tale of woeful experiences has been told, but no one seemed a whit the better off or the wiser for the recital. But, coming to more recent times, promise has sparkled in, and hope has been revived by, the work of Mr. William Young, Messrs. S. and T. Glover, Mr. Charles Carpenter, Dr. Colman, Messrs. Botley, Mr. A. F. Browne, and others; and now Thursday's meeting of the Southern Association has considerably brightened the promise that the gas engineers' almost common enemy is positively within a few steps of restraint. If the prediction proves correct, and the hope be fulfilled, the honour of being first in publicly drawing attention to the newest phase of the latest research, and apparently successful endeavour, in this particular direction will be upon Messrs. Young and Glover and Mr. Carpenter, who, working independently, have dropped into the same line, and have, it seems, brought themselves and the mobile enemy into close quarters. Such, however, is our reading of what transpired at the Southern meeting; and the confident tone of the paper and discussion upon the subject emboldens us to say that the meeting marks an important stage in the investigation and correction of the long-borne trouble.

The paper read was the joint production of Messrs. William Young and Thomas Glover. The features of the contribution are outlined in an article in our "Essays" columns; and therefore here it is unnecessary to do more than state broadly, without following the authors' line of reasoning, that they propose to deal with naphthalene by an improved system of condensation. The process consists in collecting the denser tars from the gases while they are still warm and holding in diffusion a considerable proportion of the high-tension hydrocarbon vapours capable of being removed from the gas by condensation and solution. The tars may be separated in the manner described in the paper, and then passed to a cooling and settling tank, from which the cooled tar is sent into a combined condensing and washing arrangement, by which it can be brought into intimate contact with the gas—the hot gas and the cold tar being made to flow in opposite directions. The cooled tars having been removed from the gas while warm are comparatively free from naphthalene, and, employed in the way described, would exercise their maximum solvent power for the naphthalene, and would, in turn, as the authors show, be subjected to a distilling process, to recover and retain in the gas the more volatile vapours. Here we have a distinct proposal, underlying which is logical and scientific reasoning, and one of its beauties is that the system of gas manufacture itself which produces the evil is drawn upon for the cure, and outside aid is not invoked.

The proof of the efficacy of some such system is furnished by Mr. Carpenter. Without going into the refinement suggested by the authors in regard to the separation of the tar, he—through what was, before solution, a strange experience with naphthalene in the application of his reversible form of condenser at Rotherhithe—has already gone a long way in the adoption of the proposal made in the paper. The experience referred to sadly shook his faith in the total conclusions he had drawn from the working of the Bankside reversible condenser. But, undaunted, he persevered; and, to make a long story short, he was led to try the effect in the troublesome condensers of the use of tar drawn direct from the tar-well. The trial was successful, and the difficulty was surmounted. The lessons and the value of the experience are plain; but we will not go further into the matter—preferring that the paper, Mr. Carpenter's statement, and other parts of the discussion, should be read to get the whole story, which to say the least, is full of encouragement and fair expectation.

The technical part of the meeting on Thursday was exclusively devoted to naphthalene; and it has opened up an altogether new interest in the question. At the close of the discussion on the paper, Dr. Harold G. Colman entertained and instructed the members with a description of his method of estimating naphthalene in gases. In addition, the Hon. Secretary (Mr. J. W. Helps) made an announcement on the subject of the naphthalene inquiry which a Sub-Committee have in hand. His few remarks indicate that they are setting themselves to the work earnestly and thoroughly; but to make the issue one of value, they must be supported and aided freely and well by all to whom appeal has been made. The work is one that will be of benefit to all gas undertakings; and therefore it should be (it ought to be unnecessary to say) generously helped on by funds and information by all who have been solicited to contribute one or both. The investigation is to be confided to a chemical and gas expert, working with the Sub-Committee; so that the inquiry will not suffer through the want of an efficient and competent central head, with time at his disposal for adequate research.

We cannot close this necessarily cursory review of last Thursday's proceedings, without a word of congratulation to the Committee of the Association on the change they have made in their place of meeting. Notwithstanding the vastness of London, suitable quarters for the meetings of small technical societies are still a need. But the change the Southern Association has now made is certainly an improvement on all previous experiences. One other point upon which the members may be complimented is that they have succeeded in persuading Mr. J. Tysoe, of East Greenwich, to occupy the presidential chair in succession to Mr. W. E. Price, who has had an excellent year of office. All going well, too, in the following year (1904), the younger members will have the satisfaction of seeing themselves represented in the highest office by Mr. Douglas H. Helps, who has served the Association well, when occasion called, as the *locum tenens* to his brother in the secretaryship. He is now stepping into the vice-presidency, on the elevation of Mr. Tysoe. Altogether, with the members who were present at Thursday's meeting, we look back upon it, and to its promising future effects, with the utmost satisfaction.

An Ignored Aspect of the Industrial Question.

THERE is one aspect of the actual position of manufacturing industries and mercantile enterprises which has not been discussed in connection with the three-cornered controversy between trading municipalities, statutory companies, and "trusts;" yet is perhaps the most engaging of the many points of view from which the general subject may be studied. It has to do with the interesting problem of the influence of the modern conception of the undying corporation—a body "with perpetual succession and a common seal"—as the principle of carrying on a business concern, in contradistinction to the older system of enterprises terminable with the life of the individual founder or of the members of the firm with whom he associated himself. We are not aware, at the moment of writing, that any particular study has been made of the fundamental differences which so radical a constitutional change must needs make in the methods and aims of business; and the absence of such a review of the facts of the modern commercial system appears to explain much of

the unreasoning fear that has been expressed of the ultimate results of the operation of the "trust" system. It is impossible for us, with only a limited purview, to do more than note the lack of a comprehensive body of economic doctrine relating to this order of considerations affecting the methods of modern industrial enterprise; but we venture to make the point, which happens to be illustrated by the history of gas supply, in the hope that abler hands will take it up and give it a more thorough application. It is only necessary to turn one's thoughts back to the historical origins of commerce, and to observe what goes on around us every day in regard to the starting of private business concerns, to perceive that the beginnings of trade are everywhere and always the same. People try their luck in trade of all kinds for the same object, and endeavour to obtain the same rewards. The first thing that strikes an onlooker in this performance is the individuality, or the selfishness—not to use the term in a bad sense—of the motive. A private adventurer goes into trade on his own account for his own private gain in the first place. Until he is assured of a sufficient return in this kind, no other consideration has for him the smallest value. The business must be profitable, and sufficiently so, to justify its continuance. After this has been satisfactorily established, one secondary consideration after another can be attended to. The undertaking can be extended and developed, new branches can be added, the quality of the commodities dealt in can be improved, and the retail price reduced. Eventually the head of the firm finds himself called upon to serve his generation in various other ways; and those by whose faithful services his fortune has been garnered are discovered to have interests in continuing the business even exceeding in their totality that of the proprietor himself. The successful business house has become an institution.

At this stage of the development of a commercial concern, it is time to look ahead and around and lay plans for the future. In times past, in this country, it was the almost universal rule that when a successful merchant had made his fortune, he should retire from business and set up a family establishment suited to his means. Happily for England, as the majority think, this is still the rule with many who have been fortunate in business; and the great body of landed gentry of the country is continually being recruited by this means. In France, a distinctly lower standard of achievement in the same sense has had less admirable consequences. There, small tradespeople have a propensity to pinch, and screw, and save until they can amass enough, when invested in *rente*, to live uncomfortably upon in undignified idleness. This is the individual side of trade carried to its extreme. Small properties are the rule, both in and out of trade; and anything like large enterprises are exceptional. We do not forget such notable exceptions as the big *Magasins* of Paris, and the mining and manufacturing undertakings of the Nord. Apart from these, however, and in any of the many thriving towns of Provincial France, there may yet be seen in full swing the order of commercial life once prevalent in England also—a multiplicity of small businesses, all much of a muchness as regards capital value. The system is thoroughly popular, and tends to perpetuate itself. Sons and shop assistants save a little from their earnings, and borrow the balance to take over the business from the retiring proprietor; and it occupies them almost half their business life to get clear. Then they "put by," and expect to be bought out in their turn.

Some undertakings, as railways and gas supply, could not be carried on by this terminable system; and, accordingly, the perpetual corporation was created to meet the requirements of these special cases. It has been found that the same observation applies, with some differences, to the case of the larger industrial and mercantile concerns which it is the special genius of English commerce to make out of small beginnings. The plan of running these large concerns for a lifetime, or perhaps two, has not usually proved satisfactory—indeed, it has been disastrous in many instances. Somebody has built up a great business, taken all his money out of it, and left it to go to rack and ruin. This has been the true story of the perishing from the land of some of those national industries, as the coal-tar colour industry, to which foreigners have since succeeded. The original proprietors made their fortunes out of them, and thereafter ceased to take any interest in the continuance of the trade. Why should they? Or, the founders' sons have shown no aptitude for carrying on the business after their father's death; and it has perished accordingly. In the world's everyday records there is nothing much more pathetic than the cases of old clerks and foremen who, having spent their best years in one employment, are cast aside in their old age by reason of the decay or the change of proprietorship of a privately-owned concern. Nobody can help these things; but they are painful all the same.

Now, the joint-stock system, and its development, the "trust," are in a sense a means of solving this particular riddle of modern industrial life—that of how to secure a perpetuity of what has become worth many people's while to preserve. The old rule of personal interest does not provide any remedy for its ascertained deficiency in this respect. There is no good reason why a shopkeeper or a merchant who has made a competence should not retire from the business that has produced this satisfactory reward for his commercial merits. But there is also much reason—many personal reasons, usually—why the concern should not be thereby brought to an end. Of course, it can usually be sold to a fresh purchaser; but in this event the old hands, and possibly the old customers, are liable to suffer. On the whole, therefore, it does not appear that there is anything fundamentally vicious in the principle of joint-stock trading, or even in the "trust," provided that nothing is done to spoil it in the application. This is a large proviso, of course; but it is not an extravagant or an unrealizable one. So far as the idea of a "trust" goes in the direction of preventing cut-throat competition, that also is admirable. It is the notorious fact that competition which unduly concerns itself with price has destroyed many once prosperous trades, and made many manufactures not worth carrying on. Wise men should not permit themselves to be daunted by such bogeys as that of "monopoly," which are being used to frighten people from certain ways of modern commerce, and drive them to seek refuge in national or municipal intervention with the natural developments of individual enterprise. We have shown here (however briefly and imperfectly) that the soulless trading "corporation"—not municipal—really has its beneficent aspects, and also that these are not always remembered when questions of the day are being discussed. Farther than this it is impracticable to go for the present; but concrete illustrations of our views in this respect will occur to many readers of these lines.

Continental Gas Experiences.

It is always a matter of considerable interest to have, after the immediate past history of the home gas companies has been written and published, the contemporaneous experiences of the Imperial Continental Gas Association for comparison. The reports of the Board, and the comments thereon of the Chairman (Mr. T. H. Goodwin Newton) are, as a rule, models of completeness and clearness; and they enable one to judge with preciseness the way the current is running with the concern, and the relation its trend has to gas affairs in this country. There is a sameness between the story of the Association's operations in the first half of this year and that of the home gas undertakings. The growth of the actual gas business has been on a moderate scale—only 2 per cent.—owing to the mildness of the climatic conditions in the portion of the half year that should, under normal circumstances, have been the most productive. But this lowness in the accretion of business in a period such as last half year is nothing that need give the proprietors the slightest uneasiness. It is no real index to any lessening of stability or vitality. On the contrary, they have eminent cause for congratulation in the fact that new consumers have been coming in with quite a vigorous rush—the extension in number during the half year being equal to no less than 10 per cent. This is the direction in which to look to see whether stability is being maintained and increased; and it is being with substantial measure in the case of the Association. It may be true that a large proportion of the increase is constituted of the prepayment meter consumers; and it may have been well, as the Chairman did, to warn the proprietors that individually this class of custom was small. But with all deference to the Chairman, we are disposed to think that he should not have left the point there—that, in the hearing of the proprietors, he might have made more than he did of the part that this class of consumers plays in broadening and strengthening the base upon which the Association's enterprise is built. Small, comparatively, though their individual consumption may be, the presence of 44,490 of these customers among the 291,000 consumers now upon the books of the

Association constitutes a branch of business of no mean importance. Besides, their number is still growing; and if it continues to do so in the present ratio, we may see the day when they will equal in numerical strength the ordinary class of consumer.

In another matter, the course of the Association's operations has followed closely that of the experience in this country. While coal has cost less, the returns from coke have considerably diminished—to the extent, in fact, of no less than £84,000 compared with the corresponding half of 1901. But it says something for the capacity of the business, when the Directors, in face of this, can show that the profit on the half-year's working only suffered reduction to the amount of £27,000. The proprietors, however, can look with equanimity upon temporary depressions in profit such as this, with a dividend equalization fund amounting to £369,000, and which has only been drawn upon to the extent of £41,000 in the past five years. That, on a business of the magnitude of the Association's, it has only required this sum to uphold a 10 per cent. dividend in such stormy weather as the gas industry has experienced in the period named, is another feature of which the proprietors may be proud.

A further piece of news in the Chairman's speech, at the meeting of the Association last Tuesday, will interest gas managers in view of its novelty in these days of gas-supply districting in this country. Between the Association and the Frankfort-on-Main Gas Company, there has hitherto been very sharp competition; but the municipal authority has come in with the electric light, so that there has been a kind of triangular fight proceeding for business between the three suppliers. The two Companies have now come to a working arrangement by which they will "pool" their profits, and divide them in a proportion agreed upon. The gas forces will thus be combined against the electric light; and regarding the prudence of this move there can be no two opinions. A reply given by the Chairman to a shareholder makes it plain that the Gas Companies are not at all anxious to become possessed of the electric lighting of Frankfort. But this reminds us that, from time to time, the Directors of the Association have reported the acquisition of an electric light undertaking, and the investment of capital in such undertakings in order that they may control, or else influence the control. This may be, and no doubt is on the Continent, a good policy on the part of the Board; but it would be a matter of supreme interest if they would publish some specific information as to the progress these electrical concerns are making in view of the wise and active administration of the Association's gas affairs. We remember hearing Mr. Newton once say that the Board gave the electrical part of their business equal attention with the gas; and, herein, we have a greater reason for being a little curious as to the headway that is being made. While in these two latter respects we find variations from the common experience and practice of gas companies in this country, in one other regard again the Association presents a companion picture to what we see around us at home—that is, the ever-growing necessity for new and important extensions of works. This is a requirement over which the proprietors may also be thankful, as it further certifies the strength and life existing in their great proletaneous concern. At the meeting last Tuesday, Mr. Corbet Woodall made his first appearance before the proprietors as a Director, and was very heartily greeted.

Mr. Beal's Address to the American Gaslight Association.

THE annual "convention" of the American Gaslight Association has been held in New York, under the presidency of Mr. W. R. Beal, one of the potent personalities who have during the last few years obtained celebrity in regard to the struggle for predominance in New York gas affairs. A full abstract of Mr. Beal's Inaugural Address appears in another column; but not the least interesting point of the whole thing is what does not appear on the surface—that is, the status and local reputation of the author. Mr. Beal himself was not oblivious of the piquancy of the situation; for he began by mentioning the existence in New York of problems of competition and combination, of municipal privileges and interference, and of fiscal questions "as "numerous, as perplexing, and as indefinite as may be found "in any other city of the world." Seven times has the American Association met in New York since it foundation in 1873. The previous occasion to the present was in 1899, when it happened that the Gas Companies supplying the city were engaged in the fiercest competition. The nominal prices of gas were 50 cents and 65 cents per 1000 cubic feet; but in competition districts gas could be had by keen business men for almost anything they chose to stipulate for in bargaining. This phase of the metropolitan gas supply of America has passed away, for the time being at least; and Mr. Beal, who knows as much about this part of the subject as most, is at present able to declare that for the first time in its chequered history the business is administered "without the embarrassments, the "friction, and the wastefulness of competition." The history of this competition is briefly written in the statement that since the first New York Gas Company was organized in 1823, twenty-five Companies have built works and carried on business in the territory now known as Greater New York. Mr. Beal makes the bold assertion that the business is in such an assured position that it can claim, and will secure, such judicial consideration and wise management that "it will permanently meet all the needs of our "growing metropolis, and be satisfactory alike to owners "and citizens." So mote it be! Only one cannot help thinking that a financial and administrative past so troubled is not the best guarantee of an unruffled future. While the causes of the old turmoils persist—and in Mr. Beal's observations there is no proof of their cessation—the same consequences may reappear at any time; and it therefore needs something more than the complacency of the victors in a long struggle to give assurance of enduring peace.

It is probably true that the material equipment of the organization that controls the New York gas supply is now being provided with a degree of substantiality and completeness unattainable under the old conditions. What Mr. Beal had to say on this head should serve to reassure, if such encouragement were needed, any doubters as to the immediate future of the gas industry in the Western Hemisphere. There are no vested interests to serve in this matter; and the very alert persons who now direct the gas supply of New York would not, one may be confident, do what Mr. Beal describes as work in progress without having full assurance that it will be wanted. Beside this proof of the vitality of the gas industry of New York and the United States generally, all minor considerations of the technicalities of the new dispositions and arrangements fall into the secondary order of significance. As a point of engineering interest, it is noteworthy that Mr. Beal has decided in favour of inclined retorts for the manufacture of coal gas, in accordance with plans which he gave with admirable candour of statement. Another vastly important conclusion appeared in this connection; being no other than the finding that, in the judgment of the New York gas administration, coal gas must again take the lead of water gas in the provision of a town gas supply for all purposes. It is indeed impossible to overrate the significance of this disclosure of policy, in such a place, and in the well-known circumstances. Mr. Beal's carefully-chosen words on this matter are deserving of the most serious attention, which they will doubtless receive from technicians the world over. The coincidence of the shortage of anthracite supply—due to the disastrous strike of miners—strongly reinforces Mr. Beal's argument; and his final observations upon the necessity of having regard to the equipment of the gas industry upon the basis of a provision for "permanent "prosperity" must carry enormous weight. Curiously enough, Mr. Beal took the opportunity for saying something for the "Trust idea," in exact agreement with the views sketched out in another "Editorial Note" of to-day—and written, be it understood, before the text of his address came to hand. Speaking from ample experience, Mr. Beal finds that this principle of trading, where it means "the "concentrated control and management of several properties "of the same sort," is fraught with the potentiality of signal benefit for the gas industry as a whole, including the consumers. He declares that the ownership or control of many companies engaged in the same or in allied undertakings by a single organization, affording as it does opportunity for a comparison of results, for classifying details, for experience in the selection and use of men and machinery, and for improved business methods and the exercise of a broadening effect upon local managers, "has done more to stimulate our

"workers and to put our properties upon a safe basis than "all other influences combined."

The foregoing is a striking endorsement of a system of organization for gas supply which originated in England, and, while yet retaining some important exemplars (of which the Imperial Continental Gas Association and the British Gaslight Company come first to mind) has for a season gone out of fashion. It was broken up in England about the same period as the somewhat similar plan of amalgamation of gas undertakings supplying the same areas took its rise. The two things are obviously distinct, and the discontinuance of the one and the popularity of the other do not really clash. Is it probable that the older "Trust" system—although it did not bear that name—may be revived? We know that in capable hands it has worked wonders in the United States, where, indeed, it is flourishing and spreading. Mr. Beal can aver that while the American Gaslight Association will grow in membership with the growth of the country, the number of singly-owned companies represented at the meetings will diminish, notwithstanding the concurrent impulse towards municipalization. Mr. Beal's opinion of the latter idea is clear and uncompromising. He admits that, in a state of society approaching the ideal, municipal ownership, "with control"—it is remarkable how distinct these two things are in the average American mind—will be both logical and desirable. In the present state of society, the practice has not been demonstrated as a success. There is not the individual incentive to the best management of a business which is regarded as a municipal monopoly; and the superior control is often wanting in character and intelligence. Some communities are naturally fit for it, no doubt; but others are very much the contrary. As Mr. Beal remarks, using a striking figure, "as a stream "cannot rise above its source, so all municipal government "is but the expression of the mental and moral attitude of "the property owners and of the voters of any city." It is usually possible to gauge the capacity of a town community for advanced self-government from the evidence furnished by its streets, public buildings, and the character of the public amusements. This is rather a hard saying; but it is probably a true one. With much else that was said by Mr. Beal, we find ourselves in complete accord; but this reference to his address has already extended to such a length that further comment upon this most suggestive pronouncement must be reserved.

Friendly Arbitrations.

Some months ago we referred briefly to an arbitration at that time in progress which was being carried out on very simple—and, as it seemed to us, on very good—lines. The matter alluded to is the arbitration between the Cromer Urban District Council and the local Water Company, to determine the price to be paid by the former for the undertaking of the latter. Of course, the adoption of such a simple procedure as took place in this instance is only possible when the negotiations between the parties are of a perfectly "friendly" character. But why should they not always be so? Why does it so often appear necessary to a Local Authority to regard the Gas or Water Company whose property they are intending to take over as being wishful to obtain from them an extortionate price, or for the same Companies to look upon the prospective buyers as being desirous to pay an unfairly small sum for the property? There may be several answers to these questions; but at any rate one is easy to imagine. This is that the sellers do name figures which are afterwards proved to be too high, and the buyers do offer prices which in like manner are subsequently found to be as much too low, for the undertaking that is to change hands. This reply is, however, by no means conclusive; for it is almost certain that it will be followed by the retort that this state of things is caused, at any rate to some extent, by the method of procedure at present in vogue. The awards made by arbitrators and umpires from time to time certainly lend some colour to this contention—the result so frequently being an almost exact splitting of the difference.

It is a great deal too much to expect that the action of Cromer will lead to any general modification in the character of the negotiations which take place for the purchase of gas and water undertakings; but the example there set is worthy of being followed wherever the relations of the respective parties are so amicable as to allow of it being done. This is more especially the case with regard to small undertakings, to which the cost of arbitration proceedings conducted in the old-fashioned manner means very often a most serious burden. To Local Authorities who may be desirous of taking over the gas or water property in their towns, we would therefore say: First shake hands with the Company whose works you are going to buy, and then see if you cannot come to some arrangement with them to determine the price to be paid in somewhat the same way as was done at Cromer.

Last year the Cromer Water Company obtained an Act of Parliament, in which it was provided that, if the Council wished, they could at any time within two years purchase the undertaking under the provisions of the Lands Clauses Acts. The Council promptly served notice to treat; and as no agreement as to price was arrived at between the parties, the Council nominated Mr. Henry Rofe, M.Inst.C.E., as Arbitrator on their behalf, while the Company appointed Mr. E. M. Eaton, M.Inst.C.E., to represent them in a similar capacity—Mr. A. J. Ram, K.C., being selected to act as Umpire. It was agreed between the Parliamentary Agents that a formal meeting should be summoned by the Arbitrators, at which the Solicitors and their clients should attend and tender such evidence as the Arbitrators, by previous requisition, should require. At the meeting, no Counsel were to be employed on either side, and no independent expert evidence was to be called beyond that required by the Arbitrators. The Arbitrators were to appoint an Accountant, to examine the accounts of the Company and summarize the figures over a number of years for their guidance; and he was to attend and offer any explanation asked for. Then it was provided that, if any matter of controversy arose at the first meeting which the Arbitrators, or either of them, required argued and dealt with by further evidence, there should be an adjournment, and the parties should be left discretion as to the employment of Counsel and the attendance of witnesses at any subsequent meeting. In conclusion, it was agreed that these provisions should not control the powers of the Arbitrators.

From the report of what took place which appears in another column to-day, it will be seen how satisfactorily this arrangement worked out. A meeting was held in May, at which Mr. Samuel Wood (the Accountant selected) furnished full statistics regarding the Company's accounts, and Mr. J. C. Melliss, M.Inst.C.E., the Consulting Engineer to the Company, described the works to be taken over. Very little other evidence was given; and no definite claim was made by the Company (though their Solicitor, in order to conform to the general custom in this matter, did, as a pure formality, mention a sum at which the Company would be prepared to sell). The simple facts of the case were placed before the Arbitrators; and they were left to make their own deductions from them, which, of course, they were perfectly well able to do. The inquiry was then adjourned till September, to enable information on certain points indicated by the Arbitrators to be obtained for them. The stipulation contained in the agreement between the parties that, at this subsequent meeting, Counsel and independent witnesses might be employed by the parties, was not taken advantage of; nor was there any need for it to be. A week after this second meeting, the Arbitrators published their award; and the whole matter was at an end—the works being taken over a few days later.

The Question of Liability for Forged Transfers.

The judgment in the case of *Sheffield Corporation v. Barclay and Others*, commented upon in the "Journal" for last week (*ante*, p. 1202), has aroused much interest in business circles, and has, moreover, excited much apprehension. The view taken generally is that the judgment creates a very serious situation for all persons buying stocks and shares by deed of transfer, and places the liability upon the shoulders of the party least able to detect a forgery in the deed. A correspondent writing to "The Times" of Wednesday last, truly remarks that, if matters remain as they are left by the Lord Chief Justice's decision, "no business man, be he "banker, merchant, or manufacturer, can be sure that he "may not be liable for an action if he have at any time "executed a deed of transfer as acceptor and afterwards "executed another as transferror." And, of course, the same remark applies to all other transferees besides business men. Moreover, even if the purchaser has not re-transferred the

purchased shares, he may at any time find that the shares are no longer his; the deed for which he has paid the consideration being invalid. The question generally asked is, naturally, whether there is any easily obtained remedy for what, if the judgment be upheld, will be a serious position.

The writer of the letter to "The Times," to which we have referred, suggests legislation upon the following lines. He would have Parliament enact: First, that the registrar of every corporation and company shall send, by registered letter, a notice to every stockholder (whether holding the stock in sole or in joint right) informing him whenever a transfer purporting to be signed by him is presented for registration; second, that every corporation and company shall be liable if its officials register any transfer giving a palpably insufficient address; third, that every corporation and company shall insure against fraud and forgery—being authorized to make all necessary charges for so doing.

To the first two of these proposals there are no objections to raise; the first having been pointed out in our last week's article as a wise precaution to adopt. But it is open to question whether legislation is required to make these two regulations practically compulsory. Nothing, so far as we can see, in the Lord Chief Justice's judgment would relieve a corporation or a company of liability for a forged transfer if either of these regulations had not been carried out. He very definitely put it on record that, in the case before him, "there was no negligence either on the part of the defen- "dants or their agents, nor on the part of the Registrar or "any official of the Corporation." We doubt if that could be said if the precautions described in either the first or second of the above proposed regulations had been neglected. The third of these proposals is, in effect, that all corporations and companies should be at once compelled to adopt the Forged Transfers Acts of 1891 and 1892. These Acts enable companies and other bodies to compensate out of their funds any person suffering loss from a transfer of securities made in pursuance of a forged transfer or a transfer under a forged Power of Attorney, and authorize them, if they think fit, to charge to the transferee for thus relieving him of all liability—or, in other words, for guaranteeing the indefeasibility of his right to the stock transferred to him—a fee not exceeding 1s. per £100 transferred, such fees to constitute a fund out of which compensation payable under the Acts may be discharged. The Acts reserve to the companies adopting them the same rights and remedies against the person liable for the loss as the person compensated would have had, and allows them to impose such reasonable restrictions on transfers of their securities as they may consider requisite to guard against losses arising from forgery.

Is it desirable that every company should be compelled to adopt the Forged Transfers Acts, and thereby to give its shareholders an indefeasible title to their shares, at the expense and to the annoyance of all purchasers of shares by transfer? If the *Sheffield Corporation v. Barclay* judgment be upheld upon appeal, and—an important qualification—if transferees be found to have no rights or remedies, in the event of the transfer proving to be a nullity, against the brokers who acted for the transferrors, the answer might be in the affirmative. But, failing these contingencies, the case for the compulsory adoption of the Forged Transfers Acts remains to be made out. If transferees buying through brokers are entitled to recover from the selling brokers in the event of the transfer deed being forged, there is small chance of injustice being done by making transferees liable to the company, seeing that most purchases of stocks are made through brokers, except where purchaser and seller are personally acquainted or where the purchaser is a banker taking scrip as security; and bankers should be compelled to take all possible precaution against forgery in such cases, and are in most cases in a position to detect it. There is certainly no need for hasty legislation on the subject.

The Value of Observation.

By a rather remarkable coincidence, the present issue of the "JOURNAL" contains abstracts of two presidential addresses, in the course of which stress was laid upon the value of observation. Towards the close of the discourse of Mr. J. C. Hawkshaw at the opening meeting for the present session of the Institution of Civil Engineers, last Tuesday, he pointed out how observed facts which seem trivial in themselves may lead to much. The action of a stream of aqueous vapour, noticed and pondered over by an observant man, has brought the ends of the earth nearer to each other; the sight of a wasp's nest, and reflection upon its structure, suggested to Réaumur that wood-fibre might be used for making paper; while from the study of celestial mechanics was derived, according to M. Maurice Lévy, the knowledge which resulted in the laying down of the general principles which consitute the basis of mechanical science. Coming to our own industry, Mr. Newbigging has recorded how the attention of an observant man was directed some 250 years ago to a well near Wigan "where the water did burn like oyle," and "did boyle and heave like water in a pot"—this remarkable effect being produced by "a strong breath, as it were a wind," which, on the approach of a lighted candle, "did burn bright and vigorous;" and how, years afterwards, another, living in obscurity at Redruth, "observed" the burning of coal, and was led by his observations to try the combustible properties of the gas derived therefrom, with what far-reaching results everybody knows. The Latin poet never dreamt of this when he wrote: "*Ex fumo dare lucem*"—his mind, observant as it was, was upon something totally different. The advice given by the President, especially to the younger members of the Institution, was to train their powers of observation by taking up some branch of natura knowledge—geology or biology—and studying it as a change and relaxation in their daily round of work; for, after all is said, "it is only by observing that we can know." The result of neglecting to cultivate this quality of observation was very effectively put by Mr. W. R. Beal, the President of the American Gaslight Association, in the course of his Inaugural Address at the recent annual meeting, of which the principal portions are given in another part of the "JOURNAL." He pointed out, in connection with gas undertakings, that people have too often lost the reward which should go with long service, because they have "failed to grasp, or even to see, the possibilities in the opportunity which they have been living close to for many years." It is unnecessary to dwell upon the poignancy of the regret which too late must follow such a course; it will be only too keenly felt by those to whom Mr. Beal's words are applicable. In these days, it behoves those preparing for the gas or any other profession to assiduously cultivate the quality of observation.

A Valuable Catalogue of Scientific Papers.

It is known to probably but comparatively few people that the Royal Society have been engaged during the past forty years in preparing a catalogue of the various scientific papers which have been issued in all parts of the world since the beginning of the past century. This is nevertheless the fact, as many who have been engaged in carrying out investigations can testify. The original scheme provided for the cataloguing of the papers under the names of their respective authors only, arranged in alphabetical order. This work has been carried down to the end of 1883, and comprises twelve quarto volumes. They constitute a monument of compilation, and reflect enormous credit upon all concerned in their production; but they are of restricted utility, for the reason that they are practically sealed books to all who do not know the names of the authors of the papers of which they are in need. This defect was recognized some time ago, and therefore it was decided to prepare a subject-matter index of the same papers. Considerable progress has already been made with the work, though no portion has yet been published. Now, it is in the highest degree desirable—in fact, it may be said to be of national importance—that this great undertaking should be consummated by not only carrying the catalogue of authors down to the close of 1900 (a period of seventeen years), but by completing and publishing the subject-matter index for the entire century. This is the more necessary from the fact that the cataloguing of the scientific literature from the beginning of 1901, on the same lines, is in the hands of an International Council, who have expressed their sense of the value of the Society's work, and the obligations which men of science in all countries are under to them for having undertaken it.

And the Cost of its Production.

But who is to bear the expense of producing this admittedly useful compilation? Down to the end of June last, the Royal Society had spent £14,790 upon the work, towards which a donation of £2000 was made by Dr. Ludwig Mond in 1892. In addition, the Society have received £1000 from the Treasury; and

they have had a return of £524 from the sale of volumes. They have unrestricted control over a fund from which they have been able to draw £2394; and a sum of £341, arising from money invested until it is actually required, has also been available. These pecuniary aids amount in all to £6261 only; so that the Society have been compelled to make up the balance of £8529 out of their general income. The cost of completing and publishing the catalogue is estimated at about £12,000; and the question has arisen whether the funds of the Society ought to be burdened with any part of this expense. The Council are satisfied that the work must be done, and have not felt justified in refusing to undertake it; but they consider the time has come for them to appeal to those who are in a position to afford them substantial assistance in carrying it out, without devoting thereto any part of their funds, which are sorely needed for other purposes. They have accordingly made this appeal in a memorandum issued by the Treasurer, in which the whole of the facts, as given above in a condensed form, are fully set forth. It is gratifying to find from this document that Dr. Ludwig Mond has testified his appreciation of the value of the Council's work by generously adding to his previous gift the munificent donation of £6000, payable in four annual instalments of £1500, and that Mr. Andrew Carnegie, who has already done so much for the cause of education in England, has contributed £1000 towards the accomplishment of an object which all will acknowledge is closely allied to it. We cordially join with the President and Council in expressing the hope that others may be willing to contribute towards a fund to provide for the total cost of what is, as remarked at the outset, a work of really national importance.

A Medical Scare.

Really if our peace of mind is not altogether destroyed, it will not be the fault of the Medical Press; for it does its best, by never-ending "discoveries" of new dangers to health, to make our lives a misery to us. We have become accustomed to reading of the risks to be faced in what we eat, in what we drink, and in the very air we breathe; but now we are brought face to face with a new terror in the shape of the gas-mains which lie hidden beneath our feet. For this latest shock to our nervous system, we have to thank our contemporary "The Hospital," which recently devoted two columns of its valuable space to an article on "Fogs and Gas Poisoning." The object of its condemnation is not, however, the "honest coal gas" with which the companies "are supposed to supply their consumers," but the "highly noxious gases," which in times of fog are, it says, largely employed by them for the adulteration of the "honest coal gas." Needless to remark, the use of the words "highly noxious gases" is only a somewhat roundabout way of referring to water gas.

In Theory and in Practice.

The theory advanced is that, as water gas can be quickly produced in large quantities as occasion may require, whereas the manufacture of ordinary gas must be carried on continuously (involving the employment of enormous holders so as to meet any extra demand), when the arrival of foggy weather doubles the consumption, the difficulty is met by largely increasing the proportion of water gas contained in the product supplied to the consumers. The distribution of this gas, it is contended, owing to consumers' fittings not being in such good order as should be the case, and to the mains under the streets being leaky, gives rise to many troubles and much danger; the latter risk evidently being considered to be by far the most serious one. In the first place, of course, the fittings ought to be in order; and whose fault is it if they are not? Neither coal gas nor water gas is intended to be inhaled, any more than petroleum oil is meant to be taken as a beverage. But even our contemporary recognizes that its argument is somewhat shaky, for the writer considers it necessary to urge that two blacks make one white. He remarks: "Naturally the gas companies will say that we should look after our fittings. In this there is much reason, and would be more were it not so obvious that the gas companies themselves are amongst the greatest sinners in regard to leaky pipes. The amount of gas which the companies allow to escape into the soil is something almost incredible." Well, we are surprised. It is difficult to say which is the more foolish—the consumer who permits gas for which he has to pay to be lost through unsound fittings, or the company who "allow" gas they might sell to flow into the ground. We were under the impression that—steam-rollers, excavations, and other things considered—the percentage to which most companies had reduced their unaccounted-for gas was a remarkably small one. But our contemporary knows better, and in support of its contention points triumphantly to the explosions which have of late years occurred in electric light boxes. The accumulation of a very small quantity of gas in one of these boxes is not a difficult matter to understand; and if there was enough of it, it could, of course, penetrate into the drains, cellars, and ground floors of adjacent houses. But, unless the main or service was fractured, there would be not enough of it to do this in any quantity; and if there was a breakage of a pipe, the chances would be a thousand to one that the presence of the gas would make itself known before serious poisoning occurred. This, of course, is providing that the people in the house did not happen to be asleep at the time; if they did, and the gas reached them, the result would probably be the same whether coal or water gas was being supplied. Attention, however, is not confined solely to consideration of possible fatal poisoning; medical men are advised, in foggy weather, to be on the look-out for milder forms, indicated by giddiness and headache, with a sense of heaviness, and heat in the skin of the face. We may soon expect to hear of men who have been to a birthday party overnight explaining to their employers next morning that they are suffering from water-gas poisoning. There is, of course, no harm in medical men keeping their eyes open for the symptoms referred to; but really it is not at all necessary to take this "scare" seriously—at any rate so far as the leaky gas-mains, the "gas-soaked condition of the soil," and the additional output of water gas in foggy weather are concerned. If, however, the number of cases of giddiness and headache should be larger than usual this winter, let our contemporary urge gas consumers to perform their duty by having all fittings put in good order, and appeal to the local authorities to protect the mains as far as possible by not using unduly heavy steam-rollers.

Courtesy in Debate.

We are glad that Mr. Frederic Egner has taken in hand in our columns the criticism of Mr. R. B. Brown's paper, read before the American Association, on the subject of inclined retorts; and for the reason that Mr. Egner, with his intimate knowledge of American gas engineering, is in a better position to do this than anyone on this side. But it may be said that we do think Mr. Brown's paper would have commanded more respect than it will do had he been a little more courteous in his method and manner of dealing with his subject. To ascribe "glaring misstatements" to men with whose views one does not agree is equivalent to applying to them a terse term of rather common use and opprobrious meaning. Mr. Brown quotes figures from gas engineers of eminence in the gas world of Europe who have adopted inclined retorts—men who are as honorable in word, action, and belief, and as skilled and intelligent, as any man to be found in Milwaukee; and to make use of their figures after the opening general accusation of "glaring misstatements" is not what can be described as altogether courteous. All through the paper, prejudice is the dominant note; and it is clear that, in the writer's opinion, the men who have adopted inclines, and are continuing to do so, are deplorably deficient in sense. They have only been considering the inclined retort system from the point of view of its "undoubted theoretical beauty;" but it has been left to Mr. Brown, of Milwaukee, to consider them from a more "practical standpoint." We have our doubts as to whether the Engineers of Berlin, Edinburgh, Birmingham, Leeds, Brentford, Huddersfield, Burnley, Sydenham, London (Gaslight and Coke Company), Manchester, Rochdale, Salford, Wolverhampton, and a hundred other places that could be named in England and on the Continent will subscribe to Mr. Brown's view, or look to Milwaukee for light and leading in their methods from "the practical standpoint." It may be that horizontal retorts are the preferable system for Milwaukee, as for many other places; but that fact is surely not a sufficient condemnation of the inclined system, nor for the charge of "misstatements" that Mr. Brown levels against its advocates. Next time he takes up his pen on this subject, we hope that he will cede to others a little honesty of purpose, and allow that they (as well as Mr. Brown) are endowed with, at any rate, some amount of intelligence.

ESSAYS AND REVIEWS.

MESSRS. YOUNG AND GLOVER AND THE NAPHTHALENE QUESTION.

THE authors of the paper read on Thursday before the Southern Association—Mr. William Young, of Peebles, and Mr. Thomas Glover, of Norwich—have every reason to be satisfied with the reception accorded to it; while the discussion it provoked revealed complete agreement upon the principle of the paper. Not a single discordant note marred the chorus of approval with which the views of the authors were greeted.

The paper is one of a series, and should be read with those which have gone before. The authors, in fact, are careful to disclaim any intention to modify the views expressed in their previous communications; the paper being rather designed to bring to notice some elusive features of the naphthalene problem, and to supplement work already done by themselves and others in proposing modifications in methods of condensation designed to effectively reduce the quantity of naphthalene in the finished gas. They claim that their proposals to remove the naphthalene by solvents, as first made public at the 1897 meeting of the Gas Institute, have been accepted in theory by the gas industry in this country; but they candidly admit that British engineers have been slow to carry such theories into practice.

This attitude of aloofness is contrasted with German readiness to examine, experiment upon, and adopt new processes; for, they say: "By far the most numerous applications of the processes proposed and described have been made in Germany." It is, however, conceded that there may be excuses for British hesitancy—not the least of which is the awkward fact that neighbouring works, carbonizing the same coals, and apparently working under similar conditions, frequently furnish most contradictory evidence upon the naphthalene question. The result is that many engineers become incurably optimistic, and persist in hoping that some method may yet be discovered which shall enable the gas to become self-purifying from naphthalene, and so enable them to avoid the disagreeable necessity of purchasing solvent oils from the tar distiller. Thus, by easy steps, the truth is revealed, and a real stumbling-block in the way of applying the most suitable solvents for the removal of naphthalene stands confessed.

The paper proceeds to refer to the aim and object with which the authors, at the outset, entered upon their joint labours—viz., to show that the remedy for naphthalene troubles is to be found in a sound application of known laws. A temperate criticism of the views and apparatus advocated by Mr. Charles Carpenter and by Dr. Harold Colman follows, for the purpose of emphasizing the fact that "under modern conditions of carbonization, the proportion of condensable solvents present in crude gas is not sufficient for the absorption of the large volume of naphthalene vapour produced, unless resort is made to special treatment." At this point the authors contrast methods, new and old, in retort-house management, attributing to lower carbonizing heats the comparative immunity from naphthalene troubles experienced under the old system, and enforcing the view, now generally accepted, that the high heats of modern practice are productive of large quantities of naphthalene. The tendency of bodies having low boiling-points and high vapour-tensions to remain in diffusion in the gas, is shown to be limited by the solvent affinities of the easily condensed bodies of high boiling-points. which operate to hold them in solution—resulting in a final state of balance between these opposing forces, of which, under ordinary methods of condensation, the ultimate consequences are a gas largely unsaturated with the most desirable vapours and a tar still potentially absorptive of naphthalene.

These, though unsatisfactory, are better results than might easily obtain; for if, in the absence of necessary precautions, the solvent affinities of the tars were more fully satisfied, it would be at the expense of the gas, and would result in a loss calculated by the authors at 1d. per ton of coals carbonized. This portion of the paper is handled by the authors in the able, luminous, and fascinating manner so familiar in the writings of these authorities; and it would be presumptuous to question the substantial accuracy of their conclusions.

It follows that consideration of the conditions recited have led the authors to devise an improved system of condensation which, in brief, is as follows: The denser tars are to be collected from the gases in the first stage of condensation (their complete separation being effected by mechanical means), and passed to cooling and settling tanks. Thence, being freed from ammoniacal liquor, the cooled tar is passed into "a combined condensing and washing arrangement of any convenient form," by which the tars come into intimate contact with the gas—the hot gas and the cold tar flowing in opposite currents. Such tars, having been separated while hot, are comparatively free from naphthalene, and, possessing practically their full solvent power, will, being thus applied fractionally, in flowing against the gaseous current, exercise their maximum cooling and washing effect, and carry away deposited naphthalene. Further, being gradually heated by the warmer gas, they will part with the more volatile hydrocarbons absorbed at the cold end of the condenser, while still remaining cool enough to prevent revolatilization of the absorbed naphthalene; and they are thus themselves subjected to a process of distillation to recover and return to the gas the more volatile vapours.

The authors finally guard themselves against the risk of being misunderstood as recommending a very dense tar for the purposes detailed, and conclude by modestly defining their important proposals as being "a small and imperfect contribution to the elucidation of a perplexing question."

It would to a large extent detract from the interest attaching to the full report of the subsequent discussion which appears elsewhere to-day, to attempt to summarize the remarks of the speakers who took part in it. The views that Mr. Carpenter expressed may, however, be usefully emphasized. After praising the authors' proposals as being very clearly expressed and on the right lines, Mr. Carpenter said he had found some years ago that hydraulic main tar at 130° Fahr. was capable of dissolving 70 per cent. of its own weight of naphthalene, and that the gas leaving the hydraulic main was saturated with naphthalene. He then proceeded to make a most interesting statement regarding his latest experience with the water-cooled reversible condensers. It had never yet been necessary, he said, to clean out the Bankside condenser, and it had given no trouble whatever since first put to work. But a similar condenser had not at first worked so comfortably at Rotherhithe—becoming partially choked, and throwing back-pressure, which reversal did not fully relieve. The difficulty, however, had been surmounted by the employment of tar which was taken from the tar-well, and (under the head of a plunger pump) thrown in jets against the coated surfaces—thus washing the naphthalene out of the condenser. The cause of the trouble then became apparent. It lay in the fact that at Rotherhithe the tar produced per ton averaged only 9¼ gallons as compared with 10½ to 11 gallons at Bankside, where inclined retorts alone were worked, and where the make of gas per ton of coals was lower.

In reply to a vote of thanks, Mr. Glover very gracefully alluded to the advantages which had been his in his association with Mr. Young in the investigation of these questions. Upon this occasion it had, he said, been his privilege merely to "edit" the matter supplied to him by Mr. Young. He felt that the discussion had shown clearly that progress is at last being made towards the solution of the "naphthalene question."

COAL AND ITS SUBSTITUTES.

THE Inaugural Address delivered by Mr. J. C. Hawkshaw at the opening meeting of the current session of the Institution of Civil Engineers, last Tuesday, did not contain references to many topics of special interest to "JOURNAL" readers as did those of his two immediate predecessors, both of whom, from the nature of their practice as Civil Engineers, were more closely in touch with gas and water supply. Some portions of the address, however, dealt with matters allied to these subjects from a constructional or some other point of view. For example, quite early in his discourse he pointed out that engineers in this country cannot do without timber, and a good deal of it. To take only one instance, mining—a branch on which all other engineering depends for its supply of raw material, the metals and the fuel—in the year 1901 the number of loads of pit-props imported into this country was 1,879,810. But there is another—railway traffic—which requires an annual consumption of 3,750,000 sleepers for renewing the 90,000,000 in the United Kingdom. True, the use of creosote prolongs their life, and so somewhat reduces consumption; but nevertheless there is a yearly increase. Taking the timber sleepers laid on all the railways of the world, the President put the number at not far short of 1,495,000,000, of the value, at a low estimate, of £180,000,000. These are large figures; and allowing that much timber is still needed for engineering work, he thought it would be well to inquire whether or not the supply of material was likely to continue to be equal to the demand.

This led the President to discuss the subject of forestry, in which he has taken much interest for the past thirty years. In this country forestry is neglected; and the only place we can look to for the timber we must have is Canada. But fires have destroyed not only much forest there, but the soil in which the trees grow. Moreover, the United States is making increasing demands upon Canada for timber; and she herself, with her enormous resources in water power, will soon be a large consumer of her own forest produce. Returning again to England, it has been said that if we do not grow our own timber we can get it elsewhere, and that if the supply runs short we can use metal, concrete, or some other substitute. In 1901, rather more than 7,750,000 tons of pig iron were made in Great Britain, the value of which would be a little over £22,500,000, while the value of the net imports of timber was above £25,000,000. So that the value of the timber we import is greater than that of the pig iron we manufacture, allowing nothing for the value of the home-grown timber we use. It would seem, as the President suggested, to be high time that we began to realize in this country the position into which we are drifting with regard to our supplies of timber, for dearness of this important material is sure to effect the cost of

engineering work, not only indirectly but directly. He thinks that we should grow our own timber, and improve our water-ways to allow of its cheap carriage.

The President went on to point out that the value of timber and the cost of iron and power depend in this country more or less upon the cost of coal. The Coal Commission of 1871 estimated the supply at that time at 146,000 million tons. Since that year, we have disposed of about 5000 million tons; leaving 141,000 million tons. The question for us is not one of supply but only of cost, which has varied much during late years. In 1888, the average cost of a ton at the pit mouth was 5s. 0¾d.; in 1900, it was 10s. 9¾d., or more than double. Notwithstanding the great advance in mining processes, tending to lessen the cost of production, the price of coal is more likely to rise than to fall in years to come. Other kinds of fuel will then come more into use, among others, wood, especially for domestic consumption, which now draws more largely than is perhaps recognized upon our coal supplies. Thirty years ago, Lord Armstrong estimated that one-third of the coal raised in this country was used for household purposes. Coal, being cheap, is burnt even in our best wooded counties, and there is little demand for firewood, which is looked upon as an inconvenient form of fuel, principally because we do not understand, as other nations do, how to burn it with economy of labour and material. Then came the question: "If wood were our only fuel for all purposes, can it be shown that forests will give us the supply we require?" The President emphasized the fact that the wood fuel to meet our wants must be produced near where it is required; and it would not, he said, be safe to take the produce of an acre of land in Europe at more than the equivalent of a ton of coal a year, though possibly something could be done to improve on this if the need arose. Our 3 million acres of forest would only give us an equivalent of 3 million tons of coal—not 1½ per cent. of our present output.

However, the President pointed out that the world has another supply of fuel in the shape of mineral oil, which, being liquid, is one stage in advance towards combustion. It has many obvious advantages as regards cost, economy of space and handling, &c., especially for steamships—saving stokehole staff and weight, which, for an equal evaporation, is put as low as 30 per cent. of the corresponding weight of coal. It is used exclusively on the river fleet of steamers on the Volga, and to some extent by the Russian, German, and Italian navies. On the South Caspian Railway, 1600 miles in length, no other fuel is employed. In the United States, the South Pacific Railway has 300 engines fitted to burn oil, and its use on railways in America is extending. In this country, the Great Eastern was the first Railway Company to burn oil fuel on a large scale; and others of our railways are following their example. New sources of oil are continually being discovered; but the uncertainty of supply is the difficulty in the way of its being adopted on a larger scale for steamships, for which it affords such obvious advantages.

There is still another reserve of fuel in the world in the form of peat. The most productive area for it is the north of Germany and the adjoining parts of Denmark and Holland. In Friesland, there are bogs 1500 square miles in extent; and Germany has more fuel in peat than in coal. A square mile of bog 10 feet deep contains peat equal in heating power to more than 300,000 tons of coal. Ireland has a million acres of large bogs from 10 to 30 feet deep. The Bog of Allan alone has an area of 372 square miles, with an average depth of 25 feet. In Sweden, where peat is more largely used than in other countries, a Crown Peat Engineer has been appointed. It is estimated that the bogs would yield an equivalent of 3000 million tons of coal In Central Sweden, as much as a million tons of peat is prepared annually, mostly for metallurgical purposes. For years it has been used in Martin steel and glass furnaces. In Finland, Russia, and Germany, locomotive boilers are fired with it. It is now proposed to use peat fuel for electric power stations in Germany. It has been manufactured for fuel for many years, and much ingenuity has been displayed in devising machines for preparing it. Not only in Europe, but in Canada, peat is manufactured for fuel; and this industry could be carried on with coal even at a lower price than it is at present.

But coal is by no means running short, for the President assured his audience that many thousands of million tons still remain of the world's store. China has an enormous supply as yet almost untouched. In one province alone—that of Shan-si—it is said there is coal equal to our present yearly output for 3000 years. There is coal to meet the world's requirements for years to come. Even if this were not so, the world is no longer so dependent upon fuel, now that we are again calling on falling water to aid us in our work, as it did our forefathers when they first tried to apply the "forces of Nature to the service of man." We cannot estimate the total power which the water falling on the earth's surface would produce in its descent to the sea; but we can form some idea of the limits within which it would lie. Assume a depth of 10 inches of rainfall to flow off each square mile of land surface, the mean height of which may be taken as 2250 feet above sea-level. Then the water from the whole surface falling through the mean height would give 10,340 million horse power in perpetuity. Our present yearly output of 225 million tons of coal would only give that amount of power for little more than half-a-day! At present, the supply of water power is greater than the demand; for it is not dependent on fuel that may fail or wages that may rise. It can be supplied at a fixed rate day and night from year's end to year's end for all the time which need concern us. Low as is the price at which power can be supplied with cheap coal from central stations, it cannot compare with the cost of water power. Taking 1d. per Board of Trade unit as a central steam power station charge, and 7500 working hours, the cost of 1-horse power is more than £23 a year. In America or Europe, an electric horse power from water can be had for £5 a year, day and night, and for less than half this sum at certain stations. Connected with the subject of its use for power, the quantity of water which flows off a given area, and the rates at which it flows, are questions of ever-growing importance as population increases. Water supply for domestic purposes, for irrigating, for water-transport, and (lastly) floods, all depend, in a given district, on the answers to these questions; and they will depend largely on the nature of the surface deposits and on the character and quantity of vegetation that covers them.

The address concluded with some remarks on the relation of the biological sciences to the work of the engineer; and several instances were adduced to show how his designs and methods of construction were influenced and guided by the working of lowly forms of life.

PROGRESS OF ELECTRICITY SUPPLY ON THE CONTINENT.

An abstract translation of an interesting review of the relative progress of gas and electricity supply on the Continent, as reflected by published statistics for twenty large towns—chiefly in Germany—during the decade that ended with the year 1900, appears on another page of the "Journal." The review is the work of an able Consulting Electrical Engineer established in Vienna, and deserves notice in these colnmns, if only because it was prepared for presentation to an audience of gas engineers. The conclusions at which the author arrives are, however, of such great significance to the authorities of gas undertakings that it is important to consider, in the first place, whether they are well-founded; and, in the second place, whether, if well founded, they apply to the gas industry generally and in this country in particular, or only to the industry in that portion of the Continent of which the towns selected are directly representative.

The conditions under which gas and current are supplied in Germany allow of the consumption purely for purposes other than lighting being recorded apart from the consumption which is ostensibly for lighting purposes only. In nearly all cases, moreover, gas for lighting is charged for at a considerably higher rate than gas sold for other uses. This distinction between the quantities sold for lighting and those sold for other purposes does not, of course, obtain in this country; and it is therefore impossible to procure, with reference to English towns, the statistical information which Herr Ross, the author of the review in question, had available in regard to German towns. For this reason, we might draw from the German statistics some more trustworthy conclusions as to the extent to which gas and current respectively are sold for different uses in this country than it would be possible to draw otherwise. But any such conclusions are rendered fruitless owing to their being based on the results attained under the influence of systems of differential charges. Hence, in discussing the purport of Herr Ross's interesting paper, it is desirable to consider to what extent his conclusions have been affected by the prevalence of those systems in the towns to which his statistical data refer.

Now, during the last decade of the Nineteenth Century, the gas consumption for all purposes, in those towns per head of the population increased by nearly 20 per cent.; but the consumption for lighting only, decreased by 12½ per cent. per head of the population. Hence, while each person in the community used on the average less gas for lighting at the close than at the beginning of the decade, he at the same time enormously increased his consumption of gas for other purposes, of which the generation of power appears to have been responsible for very little increase. Hence we might reasonably conclude that, under the prevailing differential gas tariffs, the future of gas supply, when faced by the competition of electricity supplied from central works, lies almost wholly in providing for the requirements of the community in respect of heating and cooking. But clearly during the decade in question, other influences than those of the competition of electric lighting prevailed to restrict the quantity of gas required for lighting purposes. Chief among these was the general adoption of the incandescent in place of the flat-flame gas-burner. We say general adoption advisedly; for it has been found by the irrefragable plan of direct and full enumeration, that upwards of 90 per cent. of the burners used for lighting in many German towns are now on the incandescent system. The intuitive thriftiness of the Teuton, incited by the relatively high price of gas—especially when required for lighting purposes—in his fatherland, impelled him to study economy in lighting; and the upshot has been that in ten years the incandescent burner has practically displaced every other throughout Germany.

This is quite another order of things to what prevails here. Judging by authoritative statements made earlier in the year, it would probably be a liberal estimate of the number of incandescent burners in use in this country to reckon them at only

one-quarter of the total of all kinds. Hence, since an incandescent burner on the average consumes appreciably less gas than another burner, it is evident that the effect of its introduction on the total quantity of gas consumed for lighting purposes will have been, *cæteris paribus*, to cause a greater decrease in German towns than in English towns. Therefore, it is not surprising that, while the effect of the comparatively limited spread of the incandescent system of gas lighting here has undoubtedly been to check temporarily the rate of increase in gas consumption, Herr Ross finds an absolute diminution in the amount of gas consumed for lighting, per head of the population, in German towns. The general introduction of the incandescent burner sufficiently accounts for the diminution; and it is unnecessary—indeed, misleading—to attribute it in large measure to other causes, such as the competition of electric lighting.

For the rest, it is obvious that a new industry, if it makes any progress at all, must inevitably show a higher rate of increase of business than an old established, though flourishing and progressive, one. Hence, there is no cause for alarm in the apparently greater rate of progress of electricity supply than of gas supply in Germany during the ten years dealt with by Herr Ross. Furthermore, it must be remembered that gas is dearer in Germany, relatively to electricity, than here. The prices of gas coal and petroleum are so much lower in this country that even much higher rates of wages do not prevent the gas manager in England delivering gas to the consumer at, broadly speaking, two-thirds the price at which his *confrère* in Germany can deliver it. There is not the same difference in the cost at which electricity can be supplied in the two countries. Hence it follows that gas is in even a better position to hold its own here than in Germany; and the immense advance in the use of gas for heating and cooking purposes, which Herr Ross's data bring into prominence, shows that, even were a decreased consumption of gas for lighting established to be caused by other influences than the spread of the incandescent burner, the future of the gas industry would yet be very promising.

HOME OFFICE REPORT ON MINES AND QUARRIES FOR 1901.

With the issue of Part III. of Dr. C. Le Neve Foster's report to the Home Office on Mines and Quarries for the year 1901, we are enabled to summarize and collate such of the official statistics concerning the coal mining industry as are most interesting to those who have to keep themselves thoroughly acquainted with all the factors—many and diverse—affecting the condition of the coal market. The only pity is that the Home Office does not seem capable of getting out these reports at least six months earlier in the year.

The record of the first year of the Twentieth Century as far as the mineral industry is concerned is not, says the report, a favourable one; being summed up in the four words—smaller quantities, lower prices. This comment, however, is only true when the record for 1901 is compared with the immediately preceding year, which was an altogether abnormal one. Compared with average years, 1901 was a very good one for the coal industry, as the following table will show:—

Output and Value of Coal, 1898-1901.

Year.	Quantity. Tons.	Approximate Price per Ton at Pit.	Estimated Value at Mines.
1898	202,054,516	6s. 4·22d.	£64,169,382
1899	220,094,781	7 7·03	83,481,137
1900	225,181,300	10 9·66	121,652,596
1901	219,046,945	9 4·29	102,486,552

A year that shows an increased value of 60 per cent. for an increase in output of only 8½ per cent., compared with a year (1898) that was above rather than below the average, cannot fairly be described as "not a favourable one." If the average price at the pit had remained throughout the years 1899-1901 at the figure for 1898, the estimated gross receipts of the coalowners would have been £97,000,000 less than they were. Allowing for increased wages—both in regard to increased rates and to lessened output per miner—and for some increase in materials used in the collieries, that little sum of £97,000,000 has gone a long way towards making up for past years of only middling business, and has provided a comfortable nest egg for the future. It is a figure for coal buyers to remember when they are asked to deal tenderly with the poor coalowner.

The decrease in output last year, amounting to 6,134,355 tons compared with 1900, was general throughout the coalfields, but was proportionately smallest in South Wales, where it was only 0·3 per cent., and heaviest in the Midlands (6 per cent.), Lancashire (5·3 per cent.), and Yorkshire (4 per cent.). In Scotland, the output fell off by 1 per cent.; in the Northern coalfields, by 2·4 per cent. This decline in production has not taken place in consequence of less miners being employed; the number of miners engaged at the collieries having increased every year. The figures for the period beginning with 1898, showing the number of men employed underground and the average number of tons per man sent to the surface, are as follows; the average output for 1898 being corrected for the strike in South Wales:—

Year.	Miners Employed.	Output per Miner.
1898	556,364	392 tons.
1899	571,806	393 ,,
1900	613,541	374 ,,
1901	636,400	350 ,,

What lesson, apart from the well-known fact that the better wages they are paid the less work coalminers do, is to be learnt from these figures? The important one that since 1898 the potential output of the collieries at work in the United Kingdom has increased from 202 to 246 million tons per annum. That is to say, if all the miners employed in the collieries in working last year had sent to bank as much coal per head as the miners then employed sent up in 1898, the output last year would have been 245,775,745 tons instead of 219,046,945 tons, the actual total. So soon, therefore, as miners' wages have everywhere been adjusted to the lower prices now obtained for coal, and the men begin to do a fair day's work on five or six days in the week, instead of spending half their time on the cricket or football field, in publichouses, or on racecourses, there will be a big surplus of coal in the market, and prices will once more get down to the bottom. That they were very far from that in 1901, the following table, giving the principal statistics for the past fifteen years, clearly shows:—

Output, Exports, and Home Consumption of Coal.

Year.	Output.	Exported*	Shipped as Bunkers.	Home Consumption.	Per Head of Population.	Average Price at Pit. England.	Average Price at Pit. Scotland.
	Thousands of Tons.				Tons.	s. d.	s. d.
1887	162,120	23,745	6,869	131,506	3·59	4 11	4 0
1888	169,935	26,118	7,121	136,696	3·70	5 1	3 11
1889	176,917	28,119	7,737	141,061	3·79	6 3	5 2
1890	181,614	29,343	8,096	144,175	3·84	8 1	6 11
1891	185,479	30,152	8,536	146,791	3·88	7 10	6 5
1892	181,787	29,765	8,600	143,422	3·76	7 3	5 9
1893	164,326	28,357	8,126	127,843	3·33	6 10	5 9
1894	188,278	32,413	9,294	146,571	3·78	6 7	6 0
1895	189,661	32,333	9,408	147,920	3·78	5 11	5 4
1896	195,361	33,521	9,937	151,903	3·85	5 10	5 1
1897	202,130	36,042	10,456	155,633	3·91	5 11	5 3
1898	202,055	35,720	11,264	155,071	3·87	6 4	6 1
1899	220,095	42,138	12,227	165,730	4·08	7 7	7 6
1900	225,181	45,010	11,752	168,419	4·12	10 6	10 10
1901	219,047	42,850	13,587	162,610	3·91	9 1	7 11

*Including coal contained in patent fuel, but not including the coal equivalent of coke, exported.

From these figures, it will be seen that the average price realized in England for coal at the pit in 1901 was the second highest in the past fifteen years; being only 1s. 5d. per ton less than in 1900, and 4s. 2d., or 85 per cent., higher than in 1887. In Scotland, the decrease compared with 1900 was greater; being 2s. 11d. per ton. But the average was still only a penny less than double that for 1887. The figures for the current year will, of course, show further and considerable decreases; but there still remains a considerable margin for reductions before the level of 1895-7, to say nothing of 1886-8, is reached. Practically, the whole of the decreased output last year was counterbalanced by the decreased home consumption; the actual quantity of coal shipped out of the country being only 325,000 tons less than the record of 1900. Of the increase in output since 1887—namely, 57 million tons—no less a quantity than 26 millions was absorbed in exports last year, only 31 millions going into home consumption. So that, whereas exports have increased 80 per cent. in the fifteen years, the home consumption has only increased 24 per cent.

It is somewhat amusing, and enlightening as to the amount of commercial knowledge possessed by Government officials, to find it stated in the report that the reduced consumption last year "cannot be ascribed to higher cost," seeing that the average price was less by 1s. 5d. per ton. We should have thought it was a matter of common knowledge that the reduced consumption of coal in 1901 was due to the injury done to trade by the high prices obtained for coal in 1900 and the early part of 1901.

According to our usual practice, we have excluded from the figures in the foregoing table representing the coal exports, the equivalent of coal contained in the coke exported, as it is considered that coal used in making coke, either in gas-retorts or coke-ovens, should be deemed part of the home consumption of coal. The exports of coke for the past fifteen years are as follows:—

Exports of Coke.

Year.	Tons.	Year.	Tons.	Year.	Tons.
1887	661,931	1892	609,451	1897	978,327
1888	798,254	1893	602,774	1898	769,742
1889	769,480	1894	588,266	1899	867,295
1890	732,375	1895	700,064	1900	985,365
1891	859,543	1896	676,811	1901	807,671

The average price in the London Coal Market (as obtained from the published returns issued by the Coal Exchange each market day, which give the average price of the best sea-borne coal put into barge in the River Thames) was 19s. 5d. per ton for the year 1901, as compared with 22s. 9d. in 1900, and was higher than in any year from 1876 to 1899. In 1873, the average was 31s., in 1874 23s. 8d., and in 1875 21s. 8d. These last figures included the coal dues of 1s. 1d. per ton, which were abolished in 1890. Last year, coal was dearest in the London market in

January, the highest quotation being 23s.; and cheapest in July, the lowest quotation being 14s. In 1900, the lowest price was touched, it may be remembered, in March and April, a most unusual occurrence.

The imports of coal in 1901, as usual, were of no importance, only reaching a total of 7564 tons—a decrease of 2385 tons compared with 1900. Of this quantity, 6088 tons came from New South Wales (by way of an experiment in the rich cannels of Australia, no doubt), and 1066 tons from Germany. From the United States, we received 38 tons, as compared with 7879 tons in 1900, when the South Metropolitan Company made their trial of American gas coal. On the other hand, our exports of fuel to the United States rose considerably last year, the figures being: For 1900, coal 40,145 tons; coke 15,585 tons; total, 55,730 tons. For 1901, coal 95,700 tons, coke 35,116 tons; total, 130,816 tons—increase 75,086 tons. This figure shows a heavy increase again this year. The total output of anthracite in the United Kingdom in 1901 was 2,565,462 tons, of which 2,254,066 tons was raised in Wales. This fact shows to how small an extent it was possible for the United States to increase their supplies of anthracite coal from British mines during the recent strike in Pennsylvania. They were obliged to fall back upon the better qualities of hard coal, instead of anthracite, in order to get any relief from this quarter.

Apart from the coal statistics, the report contains other information of interest to the gas world, from which the following particulars are taken. The quantity of oil shale mined (of which the great bulk comes from Scotland) has increased during the past four years; the total for last year being 2,354,356 tons, valued at £589,162, as compared with 2,137,993 tons, valued at £534,498 in 1898. Twenty years ago, the annual production was less than a million tons.

The following table shows the enormous increase in the imports of petroleum during the past five years; the growth of the trade with Russia and with "other countries" being particularly noticeable:—

Imports of Petroleum.

Year.	From Russia. Gallons.	From United States. Gallons.	From Other Countries. Gallons.	Total Gallons.	Value Total £	Value Per 1000 Gallons. £
1897 .	38,182,903	146,362,889	1,119,584	185,665,376	3,335,271	17·9
1898 .	46,012,011	171,561,363	1,676,165	219,249,539	3,733,632	17·0
1899 .	69,816,972	166,192,455	4,137,940	240,147,367	4,574,989	19·1
1900 .	87,765,897	153,776,766	13,435,380	254,978,043	5,559,259	21·8
1901 .	78,206,984	162,791,889	12,785,873	253,784,746	5,070,702	20 0

We may add that the present year is witnessing a great increase in petroleum imports, the total for the first three quarters being 45,353,533 gallons in excess of the figure for the same period of 1901; and practically the increase is in "illuminating," as distinct from "lubricating," petroleums. The average price for the three quarters shows a welcome fall; being only £18·4 per 1000 gallons, or £3 8s. (0·82d. per gallon) less than in 1900.

The figures relating to the output of iron ore in this country are not pleasing, as they point to the fact that we are becoming increasingly dependent for supplies upon foreign countries; and it is obvious that British manufacturers will be seriously handicapped in competing with countries using native ore, when they can no longer depend upon obtaining the raw material at home. Twenty years ago, the output of iron ore in the United Kingdom was over 18,000,000 tons; in 1901, it was only 12,275,198 (a decrease of 1,753,110 tons compared with 1900), while imports amounted to 5,548,888 tons. The question of the exhaustion of our iron supplies is, indeed, a much more immediate one than that of the duration of our coal resources; and though the first cannot be said to be of equal importance with the second, the failure of our iron mines must necessarily have serious consequences when it takes place.

LIGHTING AND VENTILATING WORKSHOPS.

THE first report of the Departmental Committee appointed by the Home Secretary in July, 1900, to inquire into the ventilation of factories and workshops was issued last week. The members of the Committee are Dr. J. S. Haldane, F.R.S., and Mr. E. H. Osborn, the Engineering Adviser to the Chief Inspector of Factories; and in the course of their report, they say:

It has long been recognized that the best objective criterion of the sufficiency of ventilation in ordinary rooms is the proportion of carbonic acid in the air; and one of the chief points to occupy our attention was the question whether it is practicable to make use of this proportion as a legal standard of sufficient ventilation. . . . Standards have been laid down by various authorities as to the proportion of carbonic acid which ought not to be exceeded in the air of rooms. These are based partly on the unpleasant effects of air containing more than a certain proportion of carbonic acid due to respiration or artificial lights, and partly on what has been found to be a practically attainable standard of purity. The limit originally proposed by Pettenkofer was 10 volumes of carbonic acid per 10,000 volumes of air, or 6 volumes in excess of the proportion commonly found in the air of towns. De Chaumont, as the result of observations on the air of barracks, proposed as low a limit as 6 volumes per 10,000. On the other hand, Carnelley, Haldane, and Anderson concluded in 1887 that for the very crowded elementary schools of this country a lower limit than 13 volumes could not, for practical and financial reasons, be fixed, although with the present improved facilities for mechanical ventilation a much ower practical limit could doubtless now be assigned. From our own observations, we have come to the conclusion that it is reasonable to expect that, under ordinary circumstances, 10 volumes should not be exceeded in factories or workshops, unless gas is burning. The only instance in which a standard of purity has been fixed by law in this country is in the case of the artificially humidified air of cotton-cloth weaving-sheds. The maximum limit of carbonic acid allowed at any part of the factory is 9 volumes per 10,000. This regulation, which is only enforced during daylight, has resulted in great benefit, but is in our opinion somewhat stringent, except with a view to cases in which much gas is burnt during morning or evening hours in winter. We are of opinion that it would materially assist towards efficiency in the ventilation of factories and workshops generally if a maximum limit of carbonic acid allowable in the air during both daylight and gaslight were fixed in virtue of the power conferred on the Secretary of State by the Factory Act of 1901. We have found that, as a general rule, employers, and particularly the larger ones, are willing and anxious to do all that is within their power to secure efficient ventilation of their factories and workshops, and that frequently the result of their efforts is admirable. Where failure occurs, this often depends on thoughtless objections on the part of a small minority of the employees. We believe that the laying down of a legal standard would lead to such objections being overcome, and to much more attention being given to the proper utilization of existing means of ventilation. We also believe that it would have a good effect in preventing much wasteful expenditure on inefficient ventilators, &c., as it would supply a ready test of efficiency. While it would act as a means of putting pressure on backward or negligent employers, it would serve to protect from unjust criticisms those who have done what can reasonably be expected. We also think that the legal limit ought not to be fixed as low as the ordinary working limit. It may easily occur (particularly where ordinary methods of ventilation without the use of fans are employed, as is generally the case) that the air of a room which is usually fairly well ventilated, has, in consequence of exceptional conditions, become temporarily, or in particular parts, somewhat foul. A margin ought therefore to be allowed in order to meet such cases; also to cover any uncertainties due to variations in the proportion of carbonic acid in the outside air, or unavoidable errors of analysis.

The report concludes with four recommendations, of which the first is the principal one. It is as follows:—

In exercise of the powers conferred on the Secretary of State by section 7 of the Factory Act of 1901, such a standard of ventilation should be prescribed for all classes of factories and workshops not otherwise specially dealt with, that the proportion of carbonic acid in the air at about the breathing level, and away from the immediate influence of any special source of contamination, such as a person or light, shall not (except on very foggy days, when no tests should be made, on account of the vitiated state of the outside air) rise during daylight, or after dark when only electric light is used, beyond 12 volumes of carbonic acid per 10,000 of air, and that when gas or oil is used for lighting the proportion shall not exceed 20 volumes after dark, or before the first hour after daylight; the only exception to this rule to be in cases where the extra carbonic acid is produced in other ways than by respiration or combustion, as in breweries, &c.

Following the report are three appendices—the first containing the results of the examination by the Committee of the ventilation of factories and workshops; the second, a general account of the conditions of efficient ventilation; and the third deals with the determination of carbonic acid in the air of factories and workshops. The second appendix contains a section in which the Committee deal with the impurities in the air of factories and workshops, arising from (1) the persons present, (2) lights burning, (3) the floor, &c., of the room, (4) manufacturing processes, and (5) accidental sources, such as escapes of gas, effluvia from drains, or impurities from the outside air. It is the second cause of impurity with which readers of the "JOURNAL" are chiefly concerned; and on this point the Committee say:

An ordinary gas-jet, such as is commonly met with at present in English factories and workshops, consumes from 5 to 10 cubic feet of gas per hour; and this amount of average English gas produces in burning about 2½ to 5 feet of carbonic acid, along with 5 to 10 feet of aqueous vapour, and consumes about 5 to 10 feet of oxygen. The mean of two analyses by one of us of ordinary 16 to 17 candle power gas gave the following results per volume of gas burnt. Carbonic acid formed, 0·54 volume; aqueous vapour formed, 1·19 volumes; oxygen consumed, 1·14 volumes. As the aqueous vapour does not, under ordinary conditions, condense, the products of combustion are (apart from heating) lighter than ordinary air; for, although the carbonic acid is about 37 per cent. heavier than the oxygen which it replaces, the aqueous vapour is about 42 per cent. lighter, and present in much greater quantity. The mistake is often made of regarding air vitiated by the products of combustion as heavier than pure air. Roughly speaking, an ordinary gas-jet produces as much carbonic acid as three men, and as much heat as five men. The combustion is quite perfect, and no carbonic oxide is given off unless from any cause the flame is smoky, or is rapidly cooled by something in contact with it.

Were there no other products of combustion but carbonic acid and moisture, the changes produced in the air of rooms by the burning of gas would be of little practical importance apart from the rise of temperature. Lighting gas, however, contains not merely carbon and hydrogen, but also a little sulphur, chiefly in the form of carbon disulphide. This sulphur is burnt chiefly to sulphuric acid, which is the cause of the characteristic unpleasantness of air which is much vitiated by gas. The quantity of sulphur present in gas varies considerably in different towns, according as the gas is or is not thoroughly purified. . . . Air vitiated by gas-jets to the extent of 20 volumes of carbonic acid per 10,000 begins to feel distinctly oppressive, even with well-purified gas. In air vitiated to the extent of even as much as

75 volumes of carbonic acid by a good and clean paraffin lamp, we could observe no similar effect.

The relative increase of air vitiation in any given workroom after the gas is lit will evidently vary with the proportion of gas-jets to persons present. This proportion differs very greatly in different workrooms. Where there is much machinery or floor-space to each worker, the number of gas-jets may greatly exceed the number of workers. Thus in spinning-rooms there are often three or four jets to each person; consequently the production of carbonic acid after gas is lit may rise to ten or twelve times what it was during daylight. On the other hand, in the more crowded rooms, where sewing, &c., are carried on, there may be only about one jet to two or three persons, so that the production of carbonic acid is only about doubled after gas is lit.

In view of these facts, the effects of burning gas on the state of the air in any room ought always to be considered in connection with the means of ventilation. When the heated air from gas jets has prompt means of escape above, the actual vitiation of air at the breathing level may not be much increased. But when the air at all levels is allowed to mix before escaping, or is kept in mixture by belts from shafting in the roof or other causes, the effect of burning gas on the purity of the air is often very great.

A good deal may often be done towards diminishing the vitiation of the air by avoiding wasteful methods of consuming gas. [This is shown by a table.] The amount of light obtained per cubic foot of gas burnt varies greatly according to the method of consumption. The light is 48 times as great with the best as with the worst method. There is great economy in gas consumption when incandescent mantles are used. Their much more general employment in factories and workshops is very desirable, with a view to avoiding excessive vitiation of the air, and at the same time obtaining a good and perfectly steady light.

By the use of the incandescent electric light; all the inconvenience due to air vitiation and heat from gas-jets can be avoided, though the extra expense, as compared with incandescent gas-light, is considerable. The arc electric light, so shaded that only reflected light falls on the employees and machines, is in some cases very advantageous.

The most wasteful methods of burning gas are still very commonly used in factories and workshops, in spite of the greater expense and increased vitiation of air. Much improvement could certainly be effected by increased attention on the part of employers to improved methods of lighting. The most suitable methods will vary according to a number of circumstances, and skilled advice on the subject should be obtained when necessary.

The heated air containing the products of combustion of a gas-jet passes straight up to the roof in a concentrated stream. It there parts with most of its heat, and once more, unless it is permitted to escape, is slowly displaced downwards again, to be partially carried up by the flame. As, however, gas-jets are usually placed at 6 feet or more from the floor, this circulation of hot and vitiated air is to a large extent above the breathing level, so that the air actually breathed is not so much vitiated as would otherwise be the case. [The Committee illustrate this point by some tabulated analyses of the air in a room 11 ft. 6 in. high of 5700 cubic feet capacity.]

In calculating the probable effect of combustion of gas on the purity of the air of a room, it is evidently necessary to consider to what extent the arrangements for ventilation permit the heated air from gas-jets to escape without vitiating the air at the breathing level. In high rooms the air at this level will be less vitiated than in low rooms. In rooms such as weaving-sheds, where the driving-belts for machinery are constantly mixing the air at different levels, or where the incoming air is introduced at a high level, there will naturally be more complete mixture than in other rooms, so that more fresh air will be needed to keep the air at the breathing level reasonably pure.

When two or more floors are in free communication by stairs, lifts, or other communications, the effects on the upper rooms of gas burning in the rooms below must also be taken into consideration, as the vitiated air will all pass upwards. When the build ng is warmer than the outside air, the vitiated air will ascend, whether it be produced by gas or by respiration. Thus in certain cases (printing works) the air in the top floor contained an excess of 21 volumes of carbonic acid, but in the basement of only 6·6 volumes; while the air entering the top floor by the shaft of the lift contained 13 volumes in excess. Hardly any gas was burning. In other cases the excess in the air entering by the stairs was 10·3 volumes, and in the room itself 15·3 volumes; in others, the excess in the first floor was 3·3 volumes, in the second floor 5·8 volumes, and in an empty upper floor, with no persons or gas-jets, 7·5 volumes. In basement rooms the air was usually found to be relatively pure. Frequently the basement and ground-floor rooms act as intakes for the whole building.

The report may possibly be further dealt with on some future occasion.

AIR GAS FOR ISOLATED PLACES.

In commenting in the "JOURNAL" for Feb. 18 last, on the new air-gas system of the Atmospheric Gas Company, Limited, of Leeds, we distinctly stated that the arrangement had not been under inspection, but that what was then written was entirely based on information received. The remarks in the short article interested the Manager of the Company (Mr. Lionel W. Stanley); and he expressed a desire that an inspection of the apparatus should be made. A plant has since been fitted up at the offices of Messrs. Watkinson and Co., of 10, Adam Street, Strand; and there anyone who desires to make an investigation for himself is at liberty to do so.

The plant, it is seen, is very compact, and could easily be accommodated in a small outhouse or cellar. It comprises a No. 3 Keith compressor, which raises the air to a pressure of 6 or 8 inches. The air then passes through a small drum-shaped vessel, in which (only in extremely cold weather) it is heated. Thence it travels into the carburettor, which is fed automatically from a 2-gallon oil-tank fixed in a slightly higher position. The carburettor, which is an upright cylindrical vessel, is divided into three compartments. The one at the base is for the reception of the air from the compressor; the central compartment is the carburettor in which the oil is maintained at a definite level; and the top division is the drying space, in which the mixture passes through discs of absorbing material, in order that it may be delivered to the burners in a dry condition. This carburettor is an improvement on the earlier form; and it has overcome a difficulty that was first experienced through variations in the quality of the mixture causing fluctuations in the light. Besides, a rather heavier oil than formerly can now be used. Originally, the air was passed over the oil; but now, as mentioned, it is delivered at the bottom of the carburetting chamber, and is sent through the oil, which is kept at a uniform depth. In this way, the air is equally treated; the oil is used up from the bottom; and there is no accumulation of the heavier constituents of the oil, as has been found in the old forms of air-carburettors. It will be remembered that it has been pointed out before, by Professor Lewes and other authorities, that this was one of the defects in air carburetting for illuminating purposes—that, in passing the air over the oil, the lighter hydrocarbons were taken up and the heavier ones were left behind, with the result that the supply of the mixture became variable in quality. Well, we are assured, this has been overcome in this system; and an oil of about ·720 specific gravity can be used. But another little difficulty was at first found (but easily remedied) in passing the compressed air through the oil; and it was that, as the air—under pressure—splashed through the oil, it formed a number of bubbles which were carried into the house distribution system. The provision, however, of drying space above the carburetting chamber has removed all trouble in this respect.

Now a plant of the size described is capable of supplying 600 cubic feet of the mixture per hour for 4½ hours without any attention, and the 600 feet an hour is sufficient for the supply of thirty incandescent gas-burners, each giving a light of 120 to 140 candles—the former with the mixture at a pressure of 6 inches, and the latter when at a pressure of 7 inches. Where such an intense light is not required, by inserting a simple gauze check in the burners, the light can be reduced to 100 candles; and the consumption of the mixture is proportionately lowered. The burners, when treated in this way, are perfectly silent, which is more than can be said of some of the ordinary incandescent gas-burners supplied for coal gas at normal pressures. The installation is also fitted with a cluster of three high-pressure burners, working at between 7 and 8 inches pressure; but in respect to the whizzing noise there is nothing to choose between them and coal-gas burners working at the same pressure. A cluster of three lights with these high-pressure burners gives a light of about 450 candles. The burner used is a small one; and, of course, no air-supply holes are required in it, seeing that air forms such a large part of the mixture. For the 120-candle power lights, No. 0 burners are employed, with "Gem" mantles. About the burner there is nothing out of the ordinary, excepting the fact just referred to, that there are no air-supply holes, as in the usual type.

The mixture only contains 1·86 per cent. of hydrocarbon vapour; and therefore it will only explode when subject to compression on issuing from the gas-pipes. Holding a lighted taper over the open end of a gas-bracket, will not ignite the gas. This was demonstrated beyond doubt during the inspection; but the impinging of the gas against the top of the burner gives just sufficient compression to enable the gas to be lighted. The gas can also be used with gas-fires—the consumption in one of the medium-sized Clamond radiators being about 100 cubic feet per hour. A good heat is given off; but the flame is very small and intense, and (while exactly suitable for mantles) we hardly think a good incandescence could be got throughout in a gas-fire having a deep bed of fuel. Ordinary sized gas-pipes are sufficient for the distribution of the gas about a house or other premises.

These are a few facts concerning this new air-gas system, which seems to embody all the essentials necessary to ensure its successful application in many places where coal gas is not available. The cost of oil and water is put down at about ⅛d. per burner-hour; and all other charges involved would certainly be covered by another ⅛d.; so that it will be seen the gas produced under the system is far from costly.

The question of preserving the calorific properties of coal by immersion has been engaging the attention of the Admiralty, and the Admiral-Superintendent at Portsmouth, after conferring with the Admiralty Chemist and other officers, has been requested to report as to whether it is recommended to conduct experiments to ascertain the results of storage under water. If so, to what extent, and whether, by immersion on shore in a tank or well, or afloat by sinking a lighter full of coal, is recommended; whether it is proposed that the experiments should be carried out; whether wetted coal is considered dangerous for issue to ships; and whether it is considered that coal so immersed would require to be dried before issue, and, if so, how it is proposed to do this.

PERSONAL.

A BARONETCY FOR COLONEL MAKINS.

Among the honours which His Majesty has been pleased to confer on the occasion of the anniversary of his birthday, we are much gratified to notice a baronetcy for Colonel W. T. MAKINS, the Governor of the Gaslight and Coke Company. In addition to this position, which he took in 1883, in succession to the Hon. Richard Howe Browne, the new baronet is Deputy-Chairman of the Great Eastern Railway Company. He sat in Parliament for about eighteen years as representative of North-East Essex, but did not seek to retain his seat at the General Election in 1892.

Mr. CHARLES HUNT has been appointed to a seat on the Board of the Colonial Gas Association, Limited.

At the Woodlands, Mapperley Hill, Nottingham, last Sunday, Mrs. W. R. CHESTER gave birth to a (posthumous) daughter.

The Coupar Angus Gas Company have lost the services of Mr. JAMES BRODIE, their Engineer and Manager, who succeeds Mr. Thomas Whimster as Manager of the Omagh Gas Company.

Mr. W. P. TERVET, who is at present in the service of the Tottenham and Edmonton Gas Company, has been selected for the position of Assistant-Engineer to the Plymouth and Stonehouse Gas Company, applications for which were invited in the "JOURNAL" early last month.

Mr. ANDREW GIBB, after having served the Newry District Council for a lengthened period as Manager of their gas-works, has retired on a handsome pension. During his tenure of the office he introduced many improvements. He relinquished his duties on the 1st ult., and carried with him the best wishes of the Council.

Mr. R. B. HOPKINS has intimated his wish to resign his position as Town Clerk of Morley; the reason for this step being that during recent years the demands upon his time and attention, both from the Town Clerkship and his private practice, have so rapidly increased that he is advised that some readjustment of his work is desirable to prevent injury to health. Mr. Hopkins, who was appointed Clerk to the old Local Board in 1883, was engaged in the Morley Gas-Works purchase arbitration; and he has also had to deal with considerable litigation in the High Courts and the House of Lords over the new water scheme for the town.

At the opening meeting of the Institution of Civil Engineers last Tuesday, the delivery of the Inaugural Address was, as usual, followed by the presentation by the new President (Mr. J. C. Hawkshaw) of the prizes for papers submitted during the past session. Among the awards was a George Stephenson gold medal to Mr. R. PRICE-WILLIAMS, for his paper on "The Maintenance and Renewal of Water-Works;" and the Miller Scholarship, tenable for three years, and the James Forrest medal were presented to Mr. HERBERT F. LLOYD, of Birmingham, for his paper on "The Design, Manufacture, and Erection of Wrought-Steel Conduits for Gravitation and Pressure Water Supply."

The appointment of Assistant-Engineer to the Cambridge University and Town Gas Company, for which applications were invited in the "JOURNAL" for the 14th ult., has been obtained by Mr. FRANK LESLIE WIMHURST, son of Mr. H. Wimhurst, of Sleaford. The successful candidate was a pupil for six years of Messrs. R. & J. Dempster, Limited—going through the whole of the shops and the drawing office, and erecting plant at some of the most important places for which the firm had obtained contracts, including the new gas-works at Wolverhampton. He remained with them for about a year after completing his articles, and was then appointed Assistant-Manager and Secretary of the Newmarket Gas Company, which position he relinquishes next Saturday to go to Cambridge. Mr. Wimhurst took a first-class certificate in the Honours Grade in "Gas Manufacture" last session at the City and Guilds of London Institute.

Out of about thirty applicants for the position of Gas and Water Engineer to the Leigh (Lancs.) Corporation, in succession to Mr. John Foster, Mr. JAMES GIBSON, the Gas Engineer and Manager to the Beverley Corporation, has been selected. The successful candidate served an apprenticeship to general engineering and draughtsmanship, and was for a year draughtsman in the works and offices of Mr. D. W. Porteous, civil and mechanical engineer and ironfounder, of Paisley. He was subsequently for four years assistant to Mr. George R. Hislop, the Engineer and Manager of the Corporation gas-works in the town, and assisted in all the numerous extensions carried out during that time. In the Technical School he gained certificates in the subjects of machine construction, steam, theoretical and applied mechanics, practical chemistry, mathematics, science, and geometry; and he holds the City and Guilds of London Institute's technological certificates in "Mechanical Engineering" and "Gas Manufacture." He has been for nine years and a half at Beverley, during which period he has introduced the system of hiring out cooking stoves and providing small cottages with fittings, slot meters, and gas-fires, all of which are fixed free of charge, and are largely used throughout the town. He has also reconstructed the works, and increased their capacity twofold, while barely doubling the capital. Although Beverley is practically stationary as regards growth of population, the consumption of gas has increased about 80 per cent. and the price has been reduced from 3s. 4d. to 2s. 6d. per 1000 cubic feet. The present make is 74 million cubic feet per annum; that at Leigh is nearly twice this quantity.

The Freedom of the City of Exeter was on Thursday last conferred on Mr. H. A. WILLEY, in recognition of his public services and generosity in the establishing of the Manual School recently opened by the Lord Mayor of London. The Mayor(Mr. Dunn) said that Mr. Willey had rendered great municipal service, and had shown great public spirit and exceeding public benevolence. He had presented to the city schools of untold value, by which not only Exeter, but the county of Devon, would benefit. Mr. Willey, in acknowledging the honour conferred upon him, said he esteemed it the more because it was an honour which was about to be bestowed upon his father at the time of his death. He felt a legitimate pride in being an Exonian from the fact that for some hundreds of years their family had been in Exeter, father and son, leading, he hoped, honest and useful lives. As to the Manual School, he conceived the idea of providing it from reading a speech by Sir John Gorst in 1889, in which he said that we must give our own countrymen the same opportunities of learning as foreigners had.

OBITUARY.

We regret to record the death last Saturday, in his 73rd year, of Mr. JOHN AYRIS, M.Inst.C.E., who was associated with the Norwich Water Company for the long term of 51 years, for 44 of which he held the position of Manager. This, owing to advancing age, he relinquished at the close of 1900, and was appointed Managing-Director, at a salary of £1000 per annum, for life.

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see p. 1291.)

THE Stock Exchange has had a disappointing week. It opened on Monday with some promise. There was an unwonted briskness, and a more cheery tone. The Money Market looked propitious, and operators prepared themselves for a good time. But it all came to nothing; for a reaction rapidly set in, and prices fell, and everything became bad and dull, while business shrank to the smallest proportions. Almost the only redeeming feature was a slight improvement in the Funds. The Money Market was remarkably easy, with an abundance of supply; and rates for discount were appreciably lower. Business in the Gas Market was considerably more active than it had been in the preceding week, though it was to a very large extent restricted to dealings in the largest undertaking. The general tendency was decidedly weaker, and almost all the changes effected in quotations were in the downward direction. This fact, however, need in no way disquiet stockholders, other than those who may be compelled to realize. We believe that the fall in prices has not the slightest connection with any weakness in the affairs of the Companies, but is entirely referable to the persistent aloofness of the public, who seem determined not to buy anything at all if they can help it. This attitude will depress the very strongest of the stocks. The year 1902 promises to continue throughout a good one for the gas industry; and there is no reason why quotations should not rise, except the persistent dulness of the market. In Gaslight issues, there was a very fair amount of business marked in the ordinary, and the figures at which stock changed hands were extremely steady. The opening and the closing prices of the week were each 89¼, and the lowest figure touched was 88½. Secured issues were rather active, especially the preference, which gained a point. The maximum, however, lost one. Not much was done in South Metropolitan, and buyers reduced their price a point. In Commercials, there was little business. In the Suburban and Provincial group, there was hardly anything done either, but several changes took place. Brentford old and new and Crystal Palace debenture receded; while, in their local Exchanges, Sheffield "C" and Newcastle had a slight set-back. In the Continental Companies, Imperial was higher, but Continental preference had a fall. In the remoter world, River Plate gained on its ordinary and lost on its debenture. Business in the Water Companies was quiet, as usual, and no changes in quotations were made.

The daily operations were: Monday was quiet, and Gaslight maximum fell 1. Tuesday was the same. Gaslight preference and Imperial rose 1 each; but South Metropolitan fell ½, and Continental Union 2. On Wednesday, River Plate rose ¼; but Crystal Palace debenture relapsed 1. Nothing changed on Thursday. Friday was busier. Brentford new fell 2, River Plate debenture 1½, and Alliance old ½. Saturday was quiet. Brentford old moved down 1,

NOTES.

Light-Reflecting Power of Various Objects.

In a note on the quantity of artificial illumination required to light an apartment pleasantly, the "Ironmonger" recently emphasized the point that the objects in a room having white walls and ceiling are three times more brilliantly lighted up by the same candle power than when the walls are quite black. Black velvet reflects only 0·4 per cent. of the light falling upon it; black cloth, 1·2 per cent.; black paper, 4·5 per cent.; dark blue, 6·5 per cent.; dark green, 10·1 per cent.; bright red, 16·2 per cent.; dark yellow, 20·2 per cent.; blue, 30 per cent.; pale yellow, 40 per cent; pale green, 46·5 per cent.; pale orange, 54·8 per cent.; white, 70 per cent.; and mirrors, 92·3 per cent.

Water Purification by Ozonized Air.

It appears from some particulars given in the "Engineer" that the purification of water by ozonized air after the Vosmaer-Lebret process, is being worked at two places in Holland—Schiedam and Nieuwersluis, near Amsterdam. The coarse impurities in the water are removed by a "Rapid" filter, and the water is pumped into the top of the ozonization tank, whence it flows out at the bottom into a storage-tank. One of the plants is said to have a capacity of 5000 to 8000 gallons per hour, dealing with surface water of poor quality. The ozonized air, which is bubbled through the purification-tank, is produced by silent discharges of electricity (10,000 volts) in a special apparatus.

Free Sulphur in Beaumont Petroleum.

In a recent number of the "Chemiker Zeitung," Herr F. C. Thiele gave the following analysis of a sample of sediment of Beaumont petroleum taken from a tank car: Amorphous grey sulphur, 63·63 per cent.; crystalline sulphur, 6·81 per cent.; crude petroleum, 29·56 per cent. Phosphorous compounds and arsenic sulphides were also present; and a terpene was isolated from the alcoholic solution of the substance. The crystalline sulphur was entirely soluble in caustic potash, and the cold solution evolved a fishy smell, due to nitrogen compounds. The formation of the sediment is ascribed to pressure in the tank car, whereby the solvent power of the crude oil suffered diminution. This circumstance forms the best proof of the presence of free sulphur in Beaumont oil. The fact that the oil yields better distillates after storage is due to deposition of sulphur, which is then unable to influence the terpenes and resins during distillation.

Construction of Timber Dams.

Dealing with the above subject in a recent issue, the "Engineering Record" alluded to the generally indefinite life of timber dams, and called attention to the fact pointed out by Mr. J. M. G. Watt, M.Am.Soc.C.E., that it is just the few exceptions which cause great trouble. It appears that he has to take out some thousands of feet of good timber in order to get down to the rotting portions threatening a structure's stability. Hence a concrete dam is preferable. Where timber must be used, it is sometimes advisable to build several courses in shallow water near the shore, and float them into position. Mr. Watt has followed this plan with cribs 250 feet long, 50 feet wide, and from 8 to 10 feet high. He has found 10 inch square logs the most economical; and he builds his pens on 10 feet centres. Butt joints are used everywhere. The sheathing on the up-stream face is a layer of 3-inch plank covered by a 2-inch, breaking joints; and if placed carefully close together they do not need calking. The top layer is in two courses, the upper section being short, so that when it is replaced, it is unnecessary to draw the pool down more than from 12 to 15 inches.

Wilson Process of Smoke Prevention.

It strikes one as rather a satire upon British science that at the British Association meeting no better suggestion for burning bituminous fuel smokelessly was forthcoming than that of sprinkling a bed of such fuel with a solution of nitrate of soda. This was the device recommended by Mr. J. S. Raworth, the electrical engineer; and he testified to its efficacy in preventing smoke under trying conditions. It is described as the "Wilson smokeless process," and is said to consist in "squirting a mixture of air and nitrate of soda solution on the fire." Mr. Raworth has fitted up a Babcock and Wilcox boiler at Kidderminster to give the system a trial. It cured the smoke of the soft and dirty coal used in the district. The action of the solution of nitrate of soda appeared to be somewhat obscure; and the author's theory was that it created nuclei of intense heat, which fired the gases and enabled the injected air to combine with them. The cost of the nitrate of soda used is from 3d. to 4d. per ton of coal burnt. Having regard to the nature of Mr. Raworth's interest in the subject, it is intelligible that he would be satisfied with almost any device which promised to shield the proprietors of electric power generating stations from the law of smoke prevention; but it is remarkable that there was nobody at the Belfast meeting to hint that the Inspectors under the Alkali Works Regulation Acts might have something to say concerning the effects of burning considerable quantities of a mixture of coal and nitrate of soda in furnaces with chimneys discharging into the air of populous regions.

COMMUNICATED ARTICLES.

CONCERNING MR. R. B. BROWN'S PAPER, "WHY MILWAUKEE DID NOT BUILD INCLINES."*

By Frederic Egner.

Had Mr. Brown confined himself to a fair, frank statement in his reasons why his Company preferred horizontal retorts and stoking machinery, and had not gone out of his way to attack the character and integrity of previous writers on the subject of inclined retorts, his paper could have been heartily welcomed, as presenting the other side of the question. But as, in the second paragraph of his paper, he said: "So many glaring misstatements have been made and apparently accepted on the floors of our Gas Associations"—referring to statements made by other engineers in good faith, on or about the inclined retorts—it seems to the writer that Mr. Brown should get, as he probably will, all the attention he merits.

As Mr. Brown's paper was brought before the Association contrary to the well-established custom by which a due and proper discussion of it could have been had, permit me to draw attention to a few "glaring" discrepancies in Mr. Brown's own paper, and to call on him for proof of his unwarranted aspersions on those of others.

Mr. Brown has had considerable experience with stoking machine operated retorts—for instance, at Newark, N.J.—and which, if truly written up, would no doubt remove some of the "glamour" from his favourite apparatus, as it appears. For the writer knows exactly what he is now writing about, which evidently is more than Mr. Brown can be credited with when "tackling" the inclines. He is glaringly at sea on that subject; as to which, please consult his paper. For instance:

In Table E, he wants us to believe that 25,000 square feet of ground required for the retort-house with stoking machinery would cost $7440 less than 24,000 square feet of the same ground, when used for inclined retorts. Then, why coal bins, to contain 30 hours' supply, should cost double for inclined retorts than for horizontal retorts, is not clear, even supposing that Mr. Brown's evident idea to stretch the inclines along in a single line, instead of back to back, was the best one under the circumstances.

Mr. Brown was exceedingly fortunate in getting bids to erect his no doubt full-depth regenerative furnace-benches of eights at $3000 per bench; but there is a great deal of doubt in my mind that he was wise to figure the cost of inclines "from the quantity sheets of one of the prominent factors abroad" and "at our prices," at that. Neither does that seem to be a fair comparison, especially when so freshly attacking the glaring misstatements which he condemns.

I am quite confident that Mr. Brown could have obtained inclined retort benches of eights with a guaranteed producing power of 18,000 to 20,000 cubic feet of gas per retort in 24 hours—his Company furnishing the foundations, as per his paper—for nearly $2000 less per bench than is quoted in his egregiously misleading paper, if the latter is taken seriously. This would have made a trifling difference in Mr. Brown's figures of $64,000 in favour of building inclines—not to mention a further saving, according to his own figures, of $22,400 in stoking machinery. For Mr. Brown states that the 96 sets of charging apparatus for the inclines would cost $9600, and the two sets of stoking machines for the horizontals, would cost $32,000. We have here a total saving in favour of the inclined retort system—if Milwaukee had built inclines—of fully $86,400; not to deduct for the few other glaring discrepancies very apparent in Mr. Brown's poor excuse for a serious mistake—viz., his (previous to the morning of the 15th of October) unannounced paper.

Mr. Brown assumed an average production per retort for his horizontals of 10,416 cubic feet of gas in 24 hours. Can he give us any information upon the point where such results are obtained anywhere in Europe? In other words, he has assumed American work, which he must have known to be several thousand cubic feet higher per retort than is deemed good practice in European works, or possibly is unattainable under the conditions prevailing there, with the results obtained with inclined retorts at English works, where, be it said, though they do not produce so much per retort maybe, because life is not so "strenuous" over there, they still make, and especially sell, gas at figures we find quite impossible on our favoured Continent.

It was shown on the floor of the recent Convention in New York City, that, even with the inclines as yet in their infancy in this country, the make per retort is quite a good bit greater—by some 3000 cubic feet and more, in fact—than is assumed by Mr. Brown he could do at Milwaukee, had they built inclines.

Four years ago the writer was requested by the President of the principal Gas Company in one of our largest cities in the West, to prepare a statement showing the relative cost of a retort-house with inclined retorts, and the same with stoking machinery operated retorts—both to be of a capacity of 4 million cubic feet per day. The Company were to furnish the land upon which to build, and the foundations for the house and benches.

*Ante, p. 1209.

The Engineer of the Company assisted the writer in obtaining the cost of the material employed and labour; and *bonâ fide* bids were sent in for everything, as it was apparently certain that the plant would be erected. The results were as follows:—

Retort-house with stoking machinery	$342,335·60
Retort-house with inclined retorts	247,798·77
Difference in favour of the inclined retorts . . .	$94,536·83

It is to be hoped that Mr. Brown will be able to give us the results of his labours at Milwaukee by-and-bye, and that, as he grows older, he will outgrow his previously unsuspected tendency to asperse the motives and character of others in his chosen profession, who believe that they have some claim for fair consideration on the part of their fellows.

Of a few unwarranted remarks made by the author of the paper, the writer will not now speak. But if desired that this shall not be the last of it, he may be heard from again.

GAS MATTERS IN THE UNITED STATES.

A Gas Plant beyond the Ordinary.

Things are usually beyond the ordinary in quality or size. In this case, it is size and smallness. A few nights since, a party of chemists were invited to visit a laboratory in a city across the river, and to inspect some new apparatus. The apparatus most certainly deserved inspection, and was examined with much curiosity by those who were invited to do so. It consisted of two portions—an apparatus for making gas, and an elaborate plant for studying the gas made.

The plant for manufacture consisted of three tubular retorts of iron lined with glass and clay; the clay being used between the glass and iron to protect the glass from contact with the metal, while the iron tubes protected the glass from the flame. Both ends of the tubes were closed by iron caps, fitting free with bayonet catches and containing glass caps to close the ends of the glass tubes. These caps had glass tubes ground in, with stopcocks and other appliances fitted with the same care, by which air or steam or the vapour of a hydrocarbon could be introduced into the retort on the intervention of the person working the plant. Connected with these tubular retorts were the necessary condensers, scrubbers, and other appliances for working with the making of gas, including a steam-boiler and a gas-holder. There was also a photometer for testing the illuminating power, and a calorimeter for testing the heating power of the gas. An air-pump was connected to the apparatus for reducing the pressure, so that certain inquiries could be satisfactorily made. Connections were put in in various places, by which the product could be "side-tracked" into special holders at any part of the process of making.

In this plant was shown how the method of making gas from cannel coal differed from the process used with ordinary soft coal; and the difference in the luminosity of the gas made from damp and from dry coal was shown, and a reason for the differences was suggested to be the very obvious differences in chemical composition. What this difference might be was suggested, but was not demonstrated by analysis, as time pressed. Gas was also made from wood and from brown coal. The products were run into special holders, so constructed that a considerable minus pressure existed in all the parts of the retorts and purifiers. Means were shown for controlling the temperature of every part of the apparatus. Thus the condenser could be worked from a temperature approaching that of the retorts to one below zero, and various appliances were arranged in modification of the hydraulic main. But no matter where the operator might wish to break in and ask questions, he found everything ready for the purpose.

After we had examined this apparatus and experimented to our hearts' desire, we crossed the passage into the inner temple, in which the examinations into the chemistry of the products of this and other laboratories of much larger size are made. Here we found not only a laboratory, but a museum. There was plant of the type devised by Bunsen, of the type devised by Hempel, with many special and modern developments, and of a type devised by the owner. It was curious to see how some of the Bunsen apparatus and some of the Hempel apparatus had been incorporated into the new system of pipettes.

The first thing which caught my eye was the end of an iron pillar coming through the floor from a foundation in the cellar, on which was a slab of white marble surmounted by a paste-board box. Our host removed this, and showed us "the special deity for whose worship this temple has been built." The diety was a most beautiful cathometer reading with a vernier to $\frac{1}{10}$ths and with a micrometer screw to $\frac{1}{1000}$ m.m. I asked what possible use such a graduation could be, and was told, "Not any yet. Now it is only useful in gaining facts concerning apparatus, but readings to the nearest $\frac{1}{10}$th have a meaning."

We were next shown a group of "standard thermometers." Three of them all had been standardized, and the use of so many was to keep the standard "in order"—a means of reference as it were. A barometer loaned by the coast survey, or marked by them as standard, I did not understand, which was used for comparison purposes. The real barometer of the daily use was a simple syphon without scale or graduation read by the cathometer. We were shown that the United States barometer could also be read in the same way. There were also thermometers without graduation cathometer read, made on the plan of M. Joule. In reading these, it was literally the height which was read. While we were examining the barometers, one of the guests said: "Here, gentlemen, *is* something," with so peculiar an emphasis on the "is" that we all turned to him. On the wall was a piece of marble screwed fast; on this was a copper plate; and on this plate the latitude to the smallest determinable fraction was engraved, and a statement of the distance from the earth's centre of gravity according to the latest opinion.

The barometer and thermometer, as has been said, were simple in the extreme, and were read by the cathometer. The apparatus for measuring the tension of the gas under examination, also read instrumentally, was without graduation, but resembled Kreuster's manometer rather than Hempel's. All the reactions were made by means of pipettes resembling the latest modification of Hempel; and the gas was not passed into the "measuring-bulb" until it was ready to be finally measured. The table for making reactions was in another part of the room than the manometer. This last was a peculiarly ingenious apparatus; and in spite of—or, perhaps, in consequence of—its perfection for the purposes of measurement, wonderfully simple. I was greatly impressed with the process used to avoid the chance of getting any of the reagent into the measuring bulb, yet ensuring that every molecule of the gas got there. The whole system of apparatus and manipulation seems to me well worth description; but this cannot be done without the use of too much space and illustrations.

Instrumental and Other Errors.

In the course of the evening, a lengthy discussion grew up on the scientific value of gas analyses. The host maintained that this was considerable; but nearly all his guests dissented. One man, who as a matter of duty makes about twenty every day, declared that in the ordinary process some of every ingredient is taken up by the reagents used, in spite of the saturation theory; and he affirmed that the only ingredients even approximately determined were CH_4 and CO_2. Of course, this is a preposterous notion, for they must be quite as much out as the others; more CH_4 being present in the gas than the analyst says, and less CO_2. It was explained to us that this was the advantage of the system of Hempel, and the use of saturated reagents. The question of the absorption of gases "not wanted" by alcohol was raised and discussed; and it was plain that no one was prepared to give any more definite name to this group than that of "gases absorbable by alcohol."

In the course of the evening, someone pulled out the "Journal" for Sept. 16, and said that the objection to the fractional combustion by means of palladium was very well taken, and went on to tell of errors he had seen produced in this way. Another took Hempel from the shelf and showed what this book's teaching was, and added: "My experience is that the most trifling amount of any gas other than hydrogen is sufficient to make the determination unreliable, and with more than traces of isopentane I do not think combustion would occur—at least, amounts not measurable have prevented the union of hydrogen and oxygen through the agency of palladium within my experience." This is the experience of everyone; and I am quite sure that in some instances curious misconceptions have arisen from hydrocarbons which should have been oxidized by the fuming acid escaping the action of the acid in part or wholly. There is room for much study there, as well as for study into the special action of bromine.

An "Enriched" Producer Gas.

Among the curiosities of this fall, which may or may not remain a curiosity, is a soft coal gas producer of the simplest pattern, exhibited privately this summer and fall in Jersey City. The extreme simplicity of the apparatus makes one hesitate to believe that on a large scale perfect control can be maintained. The process may be described as the slow combustion of soft coal, slack, and sweepings, disengaging the hydrocarbons in the slack mixed with the products of combustion, CO, CO_2, and H_2O. These gases, hot from the fire, are thrown or drawn through a chamber containing tiles arranged in steps, against which is projected a spray of oil. It is said that the kind of oil is of importance—"crude Baku petroleum," as it was described to me, being considered the best.

The hot gases take up a large quantity of the oil, which dissolves in it, so to say, and both are then passed through red-hot coke. This coke is in very large pieces in a tubular retort. In passing among the pieces of coke, the water present is broken up, as is also the CO_2; the O of the CO_2 and of the H_2O uniting with the coke to form CO. Certain other mysterious reactions take place. NH_3 is formed, also CN, and are washed out as $H_3N{=}CN$, apparently in a large percentage.

It has been my good fortune to make a number of analyses of samples of the gas, which are gradually becoming more uniform; and its naked flame is splendidly brilliant—almost as beautiful, indeed, as that of the Pintsch gas, if not of acetylene. It would give me much satisfaction to publish analyses of the ultimate product, which, of course, I cannot yet do; but I can say this, that the analytical results make it very hard to understand the syntheses in the second part of the process. If so much N_2 can

be made to combine, one cannot but wonder why more will not; also, since the H_2 which enters into the NH_3 is more than can be shown to exist in the water carried over, some of it must come from the Baku oil. The carbon, too, is from the same, for the coke does not decrease in weight, but is slowly rendered graphitic.

The whole process is one of uncommon interest, and I think in time will open up a new line of thought and study, if not of industrial development. The men who have charge of the invention have, I believe—I do not really know it—made application for patents. Yet at the same time they seem quite too anxious to make a good showing—less words and more works would improve the opinion of those who have so far come in contact with them. Regularly, once in about three months, a new process for making gas is "invented" (imagined rather) and worked out partly towards a useful invention, and then is abandoned. Turn where we may, we nowhere find that much-desired man who will work out to the end a system of utilizing the slack coal which is such a nuisance at the mines. The fact that the producers used for making gas for gas-engines are using soft coal now instead of hard, or coke, shows that there is no real reason why soft coal should not become the fuel of the future if the production method is sustained.

Still, it seems to me that the so sudden springing up since the beginning of the coal strike of "schemes" for using the very dust heap of an anthracite mine will in the end show that the strike has not been wholly useless. One might go a step further and say that, since the strike began, a way has been found to use the most degraded sort of soft coal sweepings in the locomotives of the elevated road. It is known that for some time past Mr. Vanderbilt has been using the brains of many men with the determination of finding a way to make the locomotive smokeless with any coal; and those who know are telling of many successful experiments, and are saying that within a year smoke will be an unknown thing in American railroads. Personally, I wish someone would do the same for American gas.

The Unconsumed Carbon in the Residuals of the Welsbach Burner.

A man devoted to closet study has been engaged in a queer investigation, and has carried it to a most successful issue. He has been studying the "smoke" of a Welsbach burner. It is some years since, by means of a beam of light, I demonstrated that the "air" coming from a Welsbach chimney contained solid particles, and that these were the cause of the defilement of the ceilings in rooms in which the mantle light was used. But this experiment goes much further, and shows that they are carbon—in part small black diamonds, in part graphite, in part genuine "soot," and in part a hydrocarbon. The "soot," with all the rest, was collected for a year in a tube containing asbestos placed above the chimney of a fixture in nightly use; and when the asbestos was removed, its blackened condition was the cause of much surprise. The first inch or two contained all the graphite which was to be expected; but above this were some 6 inches on which was deposited a large amount of a substance which, on combustion with oxygen, gave CO_2 and H_2O. The chemical composition is not yet determined—*i.e.*, the molecular formula—but surmises are made that it will "show us a thing or two" by the time it has been fully investigated.

This is exactly in line with the facts long known in reference to the gasoline gas, but only recently demonstrated in relation to so-called coal gas. I do not know how it may be in England, but over here this trouble distinctly belongs to the enriched gases. The widespread—one might say universal—habit of enriching "coal gas" with "process gas" has everywhere been followed by the introduction of a hydrocarbon with a molecular resistance so great that it is not broken up by the temperature of the bunsen flame. This smoking of the Welsbach bunsen may be due to imperfect oxidation; but in making analyses with proper care—not in the usual way—it can be shown that, even in the explosion bulb, if air be used, this hydrocarbon does not break up. It does if the residual gases are again exploded with bunsen oxy-hydrogen and an oxygen excess. The amount of the hydrocarbon incognitum is so small that only traces of H_2O and CO_2 result; but they are distinct traces, and by making four or five explosions, ponderable amounts of H_2O and CO_2 are sometimes—perhaps one is justified in saying usually—obtainable from the result. It must remain for some time an open question; but the owner of the laboratory which has been described as the shrine of the cathometer insists that he is able to recognize a pressure difference of $\frac{1}{1000}$ mm. If so, he should be able to measure even these particularly elusive substances, for there must be more than one.

The first session of the Petroleum Institute for the year 1902-3 will be opened on Thursday, the 20th inst., at 26, Bevis Marks, E.C. During the term, lectures will be delivered by Professor Vivian B. Lewes, Dr. S. Rideal, Mr. D. A. Louis, and the Principal (Dr. Dvorkovitz).

In view of the holding of the confirmatory meetings of the Institution of Gas Engineers and the Incorporated Gas Institute on Saturday, the 29th inst., we are asked by Mr. R. G. Shadbolt, the Hon. Secretary of the Manchester District Institution of Gas Engineers, to announce that the next quarterly meeting of that body, which had been fixed for the above-named date at Bradford, will take place on Saturday, the 6th prox.

TECHNICAL RECORD.

SOUTHERN DISTRICT ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

The Autumn Meeting of the Association was held last Thursday, at the Hotel Cecil, Strand, under the presidency of Mr. W. E. Price (Hampton Wick). The change in the meeting-place was a happy one; the proceedings in every respect being conducted under more favourable and comfortable conditions than have obtained elsewhere. The attendance of members was also very gratifying; the London and Suburban gas undertakings being particularly well represented.

The President, in opening the proceedings, said he was pleased to see such a large muster of members. He felt certain when the subject of naphthalene was suggested for discussion that it would attract a good number.

The Hon. Secretary (Mr. J. W. Helps, of Croydon) presented the minutes of the last meeting; and, on the suggestion of the President, they were taken as read.

The Late Mr. Charles Gandon.

The President said he was sorry, and he was sure the members would be so too, that his first duty on this occasion was to refer to the loss the Association had sustained by the death of (he might say) their old friend, Mr. Charles Gandon. He was with them as a member a large number of years, and he took a very great interest in all matters connected with the Association and the gas industry. He (the President) was certain they one and all deeply regretted that Mr. Gandon had been called away. He therefore proposed that a vote of condolence be sent to the family of their late friend.

The Hon. Secretary asked to be allowed to add a few words. Mr. Gandon was one of his oldest friends, and he was, he (Mr. Helps) believed, one of the oldest members of the Association. He was elected 25 years ago almost to a day. That was on the 8th of November, 1877. In 1882, he was President; and he died exactly twenty years later. He was convinced that they all felt in Mr. Gandon they had, in all difficulties, a good friend—one to whom they could apply with a sure sense of getting assistance. He remembered, in his own early days, coming from the West of England to see Mr. Gandon on a point of difficulty; and nothing impressed him so much as the manner in which he met him, and helped him in the matter on which he (Mr. Helps) wanted aid.

The motion was carried by the members silently rising.

Election of President and other Officers.

The President said his next duty was a very pleasant one, and that was to propose the President for 1903. The name he had to mention, he was certain, would be very heartily received. It was that of Mr. J. Tysoe, of East Greenwich. He had been a member of the Association for many years, and had worked as well as, and better than, many. He was sure that, in electing him for the ensuing year, they would be benefiting the Association.

Mr. J. Lowe (Weymouth) seconded the motion, which was unanimously carried.

Mr. Tysoe remarked that twelve months ago he accepted the position of Vice-President of the Association more or less lightheartedly. The time when he thought he should be called upon to occupy the higher position seemed very far distant; and consequently it had no terrors for him. But as the months rolled by, he began to question whether he was justified in taking on himself—having regard to the large and increasing responsibilities of the works under his charge—the duties of the presidential chair of the Association. However, he accepted the position; and it only remained for him to thank the members, which he did very sincerely, for their kind reception of him; and the President for the remarks he had made concerning him.

Mr. R. Herring (Dover) said he had much pleasure in proposing that Mr. D. H. Helps be the Vice-President for the coming year.

Mr. A. E. Broadberry (Tottenham) said it was with considerable pleasure that he seconded the nomination of Mr. Herring. The members had known Mr. Helps for many years; and they all felt that a better selection for the vice-presidency could not have been made. They would hope in due time to see him called to a higher office; and then he (Mr. Broadberry) was confident they would have a presidential treat at his hands.

The motion was very cordially agreed to.

Mr. D. H. Helps (Redhill) thanked the members very heartily, and remarked that he accepted the position with a deep sense of the honour and responsibility which it entailed. He could assure them that, when the time came for him to take office, he would do his best to uphold its high traditions.

On the proposition of Mr. J. L. Chapman (Harrow), seconded by Mr. W. A. M'Intosh Valon (London), and supported by Mr. W. R. Cooper (Banbury), Mr. J. W. Helps was unanimously re-appointed Hon. Secretary and Treasurer.

Mr. Helps thanked the members for the honour again conferred upon him by re-electing him to the position. It was one

of the duties which he had undertaken in which he took a great deal of pleasure. He was sure he should find as much delight in it in the future as he had done in the past; and he hoped his efforts would meet with the approval of the members.

Mr. A. F. Browne (Rotherhithe) moved the election of Mr. A. W. Onslow (Woolwich Arsenal) and Mr. Harold W. Woodall (Bournemouth) as members of the Committee. In Mr. Onslow, he said, they recognized an expert and authority upon the subject of high-pressure lighting; and, as to Mr. Woodall, he bore an honoured name, which would lead the Association and the gas industry to expect great things of him in the future. From their knowledge of him, they might confidently say that the reputation of that well-known and distinguished name was perfectly safe in his hands.

Mr. F. Smallbone (Woodford) seconded the motion, which was cordially agreed to.

On the proposition of Mr. T. Price (Walton-on-Thames), seconded by Mr. J. Hammond (Eastbourne), Messrs. A. Dougall and J. L. Chapman were re-elected Auditors.

New Members.

Moved by Mr. D. H. Helps, and seconded by Mr. F. W. Cross (Lea Bridge), the following gentlemen were admitted to membership: Mr. Frank Jones, of the Commercial Gas Company; Mr. Herbert Buckley, of Windsor; Mr. John Terrace, of Tottenham; Mr. Arthur Valon, of London; Mr. C. B. West, of Hampton Wick; and Mr. H. W. Packham, of Kingston-on-Thames.

Mr. Thomas Glover then read the following paper, which was described as the joint production of himself and Mr. William Young:—

FURTHER SUGGESTIONS FOR THE ELIMINATION OF NAPHTHALENE FROM COAL GAS.

The object of the present paper is to bring before your notice some considerations of the naphthalene problem, which we believe have hitherto escaped notice, and to supplement the work already done by the authors of this paper and others, in proposing modifications in the methods of condensation which will effectually reduce the quantity of naphthalene in the finished gas. In doing this, it should be first stated that it is not intended to modify our views in any way—either as to the necessity of treating naphthalene as a troublesome impurity, or that the most rational way to remove it is by application of suitable solvents.

It is fairly generally acknowledged that the elimination of naphthalene vapour from the gas may be successfully accomplished by the methods first published in a paper read before the Gas Institute in 1897, and since amplified in subsequent papers read before the two Institutes representing the gas industry in this country.

While it is gratifying to note this acknowledgment, it is a significant fact that by far the most numerous applications of the processes proposed and described have been made in Germany; but it is probably characteristic of the diverse views on works management in the two countries. In Germany, there is an abundance of skilled assistance for the examination of, and experimenting with, new processes. In England, any departure from proved methods is viewed with extreme caution—due to the fact that the manager with varied responsibilities of office pressing on him is unable to concentrate on to one subject the time necessary for its solution, and skilled assistants who are willing to work for small pay, are practically unknown in this country. The stringency of British laws affecting gas supply are also responsible for some of this reluctance to experiment.

This partly explains the seeming paradox of loud calls for relief from naphthalene troubles on one hand and the non-adoption of an acknowledged remedy on the other. A further explanation lies in the fact that certain works using ordinary coals under apparently normal conditions are reported free from trouble, while neighbouring works with similar coals and conditions are never long free from troublesome stoppages.

The result on the minds of many gas engineers is a persistent hope that the crude gas may yet be found to contain within itself that which, by suitable treatment, may act upon the naphthalene vapour and ensure its removal—so avoiding the introduction from the tar distiller of oils for washing. The drawbacks attending the use of washing oils have, we believe, been unduly magnified; but the desire to make the crude gas purify itself of naphthalene vapour is appreciated by us, and an attempt will be made to show one way in which this may be done.

In the paper read in 1897 (to which reference has been made), it was our aim to clearly show that the remedy for the troubles arising from naphthalene was to be found in a sound application of the laws affecting the tensions of hydrocarbon vapours in crude gas and the solvent affinity of condensed liquid hydrocarbons for the vapours diffused through the gas.

There is a variety of methods in which these principles may be applied in the process of gas manufacture and distribution. One of great interest calls for some attention before passing on—viz., Dr. Harold G. Colman's centrifugal separator. It will be necessary also to touch upon Mr. Carpenter's reversible condenser.

With regard to Dr. Colman's valuable contribution published in the "Journal of Gas Lighting" for June 3, I think we must all admit that he has given a most lucid description of the physical changes occurring during the passage of the gas from the retort to the terminal end of the condenser. His original proposal, to employ a centrifugal separator in order to give full effect to the solvent action of the light oils on naphthalene vapour at the terminal of the condenser, is one that we can understand and appreciate. The weak part of the proposal, so far as the absorption of naphthalene is concerned, is the absence of light oil vapours (especially where Durham coals are used at high temperatures) in sufficient quantity for the purpose. If proof were wanting of this fact, other than the results got by distilling the tar, we have it in the conditions obtaining in the reversible condenser, where the rate of condensation is accelerated by water cooling, and where the reversals are necessary to prevent blocking with undissolved naphthalene deposits. Moreover, it may be questioned if it is advisable to withdraw at a temperature of 140° Fahr. or thereabouts, even the heavy portion of the condensable liquid hydrocarbons, as they are practically free from naphthalene at that temperature, and their subsequent solvent action would be prevented by separation and removal.

For the extraction of naphthalene from gas, Dr. Colman emphasizes the useful part played by solvents. Mr. Carpenter, on the other hand, provides what are practically depositing chambers with cooled walls. The walls being washed down to remove the crystalline deposits by making the terminal end (where the deposits have taken place) into the inlet after the Sunday stop, the quantity of naphthalene, as ascertained by chemical tests in the finished gas, when compared with the actual weight of crystalline solid deposited in the long connecting mains to the station meters and holders at another works, shows results very much in favour of the reversible condenser. It would be presumptuous to criticize any efficient form of apparatus or method of working such as Mr. Carpenter described, which has given relief from an unmitigated nuisance of regularly recurring back-pressure of from 5 feet to 6 feet; but it is difficult for an outsider to understand how at the time deposits are being made in the last limb of the condenser, and for some time before a reverse is made, the gas can be leaving in anything but a saturated condition and ready to deposit crystals in the attenuated mains and services at low temperatures.

Both Dr. Colman's and Mr. Carpenter's papers serve to emphasize the fact that, under modern conditions of carbonization, the proportion of condensable solvents present in crude gas is not sufficient for absorption of the large volume of naphthalene vapour produced, unless resort is made to special treatment.

When coals were carbonized at more moderate temperatures, and when enriching cannels were used, the tar produced was much larger in amount, and the volatile hydrocarbons were present in such quantities as to nearly saturate the gas. Precautions had then to be taken that the temperatures and other conditions during condensation were such as to prevent the absorption of benzol and the other volatile hydrocarbon vapours with which the gas was nearly saturated. Hence the practice (to which, under the *régime* of high temperatures, too much value has been attached) of drawing off the thick tars at frequent intervals in the retort-house.

Under these old conditions, no trouble was experienced with naphthalene, because it was not produced in such large quantities, and there was an abundance of hydrocarbons deposited in the condensers to take it up in solution or to simultaneously condense with it and carry it to the drip-pots if deposited in the mains.

With high temperatures, a considerable proportion of the vapours, which under lower temperatures would ultimately condense as tar, are cracked-up, mainly into permanent gases—as carbonic oxide, hydrogen, or marsh gas; and into the stable hydrocarbons—as benzol and naphthalene. The permanent gases are, therefore, much larger in volume and capable of taking up, and holding in diffusion, a large volume of vapour. The denser tars are smaller in quantity, and therefore less able to dissolve out of the gas the vapours of the hydrocarbons diffused through it. Not only so, but the nature of the hydrocarbon vapours predominating in the gas have been changed in character; being converted into naphthalene and the very volatile benzol—those of medium vapour tension being present in comparatively trifling quantities.

These altered conditions account for the increased troubles from the presence of naphthalene; the naphthalene being produced in larger quantities, and there being a diminished production of solvent tars to take it up in solution. And, further, the hydrocarbon vapours with a higher tension than naphthalene being smaller, the increased volume of gas is less saturated by them; and the gas is in consequence capable of taking up, and retaining in diffusion during the process of condensation, an increased quantity of naphthalene. Or, to state it in another way, the larger volume of gas and the proportionately smaller volume of volatile vapours (these being mainly the vapours of benzol) and the smaller production of solvent tars, places, so to speak, a wider gap between the saturation point of the gas and the tars. That is to say, if the gas were brought into contact with a tar containing a large percentage of hydrocarbon vapours such as benzol, the unsaturated gas would take up in diffusion a portion of such benzol vapour; and, on the other hand, if the tar was brought into intimate contact with gas more highly charged with benzol vapours, the tars would dissolve out of the gas a part of such vapour.

That comparatively unsaturated condition of the gas and tars is undoubtedly the balance between the solvent affinity of the tars for the vapour and the tension of the vapour dissolved through the gas to overcome that affinity. But such conditions allow of a considerable range of temperatures being applied during the process of condensation without seriously affecting the vapours left in the gas, and consequently its illuminating power.

This point is beautifully illustrated in the process of washing the gas to absorb the naphthalene by heavy tar oils. If the tar oils were applied to the gas just as they had been got by fractional distillation, they would not only absorb the naphthalene, but also the benzol out of the gas, and would continue doing so till the solvent power of the oil for the naphthalene and the benzol was balanced by the vapour-tension of the naphthalene and the benzol to remain in diffusion through the gas. The object, however, is to dissolve the naphthalene only; and therefore, in order to saturate the oil to balance its solvent affinity for the benzol, it has been found necessary to add to the tar oil from 3 to 5 per cent. of benzol, dependent upon the quality of the gas and the temperature at which the gas is being treated. If the gas had been near the point of saturation, there would have had to be added a much larger percentage of benzol to bring about a balance.

In this process, we have a measure of the solvent affinities of the dense liquid hydrocarbons present in the tars when presented to the gas so as to exercise their full solvent power upon the illuminants in the gas, and from which we may fairly calculate what would be the consequence of so conducting the process of condensation as to allow the tars to exercise their full solvent power upon the vapours present in the products that were suitable to increase the illuminating power of the gas.

Let us assume that there will be produced from a ton of coal carbonized at high temperatures 10 gallons of tar, and that the tar contains 5 gallons of dense liquid hydrocarbons whose solvent affinity for the volatile vapour had to be balanced to that of the gas to hold them in diffusion. Taking 5 per cent. of liquefied vapour or naphtha as the quantity required to effect such balance, that would be represented by 0·25 gallon of naphtha as the total possible quantity of vapours or illuminants that would be absorbed under ordinary temperature conditions by the dense hydrocarbons present in the tars from a ton of coal, even if the whole tars and gases were allowed to cool in intimate contact with each other. That is assuming, however, that the dense hydrocarbons were pure; but it has to be remembered that, under the best systems of condensation, the tars do manage to dissolve out of the gas volatile vapours equivalent to about 1 per cent. of the volume of the tars. This would nearly reduce the solvent power of the dense tars by one-half. Besides this, we have to keep in mind that the dense tars hold in solution about 12 lbs. of solid naphthalene, or about 2 lbs. of naphthalene per gallon of solvent, which will still further reduce their solvent power. Thus it may be safely assumed that not more than one-tenth of a gallon of benzol will represent the total possible loss in illuminants per ton of coal carbonized that would result from any method of condensation, even if the solvent affinity of the dense tars were allowed full play at ordinary temperatures, or, equivalent in value, at most 0·25 candle, or about 1d. per ton of coal.

These assumptions are based on well ascertained facts, which have been fully supported by practical experience. The fractional distillation and separation of the constituents of the tars show that each gallon of liquid hydrocarbons present in such tars must hold in solution about 2 lbs. of naphthalene; and even pure gas passed over such a solution would take up naphthalene vapours in diffusion. This fact would indicate that, even with the systems of condensation in which the gas and tars are allowed to cool in contact with each other, the gas will still, under modern conditions of carbonizing at high temperatures, be liable to contain naphthalene, and that if the naphthalene is to be successfully removed from the gas during the condensing process by the small quantity of liquid hydrocarbons simultaneously produced from the coal, these liquid products must be applied in some improved manner, so that their solvent power may be exercised to more advantage than present methods allow.

A study of these conditions has led us to consider an improved system of condensation, the broad lines of which I will endeavour to indicate. The process consists in collecting the denser tars from the gases while they are still warm, and holding in diffusion a considerable proportion of the high-tension hydrocarbon vapours capable of being removed from the gas by condensation and solution.

This is accomplished by collecting the tars deposited in the foul main while still hot, and fixing in any convenient position upon the foul-gas main a Pélouze and Audouin tar-extractor, or the separator suggested by Dr. Colman, by which the liquefied particles suspended in the gas may be precipitated and collected.

The separated tars are passed, by gravitation, to a cooling and settling tank, whence (having parted with the ammoniacal liquor) the cooled tar is passed into a combined condensing and washing arrangement, of any convenient form, by which the tars can be brought into intimate contact with the gas—the hot gas and the cold tar being made to flow in opposite directions.

The cooled tars having been removed from the gas while warm, are comparatively free from naphthalene, and possess practically their full solvent power. Also—being thus applied fractionally, by being passed in among the cooled gas, and flowing back against the advancing current—they will, for well-understood reasons, exercise their maximum cooling and washing effect, besides carrying away the naphthalene as it is deposited. The tar being gradually heated, as it flows back against the current of warm gas, gives up the more volatile of the hydrocarbons they have absorbed in the cold end of the condenser washer, while the temperature is not sufficiently high to cause the revolatilization of the absorbed naphthalene, or if so, only to be subsequently reabsorbed by the less saturated tars.

The tars would thus not only be employed to exercise their maximum solvent power for the naphthalene, but they would in turn be subjected to a distilling process, to recover and retain in the gas the more volatile vapours. There would be the further advantage of employing the tars in this manner, that, being applied in the final stages of condensation, their temperatures might be conveniently regulated to that which is found suitable to give the best results.

In conclusion, may I explain that it is not intended to suggest the use of very dense tar as a condensing and washing liquid which might have more of the characteristics of medium soft pitch than fluid tar; but the line of reasoning sketched for you leads us to hope that, by separating and precipitating the tarry particles at a high temperature when there is only a feeble affinity for naphthalene, a suitable fluid may be obtained from the crude gas itself to assist in condensation and the removal of the naphthalene vapour.

Will the members of this Association accept this as a small and imperfect contribution to the elucidation of a perplexing question? Whatever may be the fate of any proposals for altered methods of working which may be made from time to time, the knowledge of natural laws underlying the processes we employ has a permanent value, and only by a true understanding and appreciation of those laws may we hope at last to be freed from the trouble incurred through deposits of naphthalene.

Discussion.

The PRESIDENT said he was sure the members were not disappointed in Mr. Glover's paper. The Committee felt when they asked him if he could contribute anything further—he (the President) said "further," because Mr. Glover had already contributed a great deal of information to the gas industry on this subject of naphthalene—that he would be able to do so; and they were not disappointed. The suggestion the authors had made had in it a considerable number of points; and he had no doubt the members would take advantage of it, and discuss and pull it to pieces. The more it was discussed, the happier Mr. Glover would be. He (the President) saw many present who had had considerable experience of processes such as this, or processes that were opposed to it. Therefore they were in a position to have a full and good discussion.

Mr. CHARLES CARPENTER (London) said he must first congratulate Mr. Glover upon the admirable paper which he had put together for the purpose of discussion at this meeting. It was admirable in two senses of the word. It clearly expressed from beginning to end what the authors wished to convey to them. Unfortunately, they could not say that of every paper given to them for their digestion. It was also admirable in respect of the matter of which it was composed. He thought Mr. Glover was on the right lines at last, and that he had made distinct progress in endeavouring to utilize the solvent action which the tar naturally possessed, rather than in adopting for that purpose a certain proportion of the solvent material which had been separated in the course of distillation. With respect to the reversible condenser of which the authors had spoken, the members would recollect that some seven years ago—in November, 1895—he (Mr. Carpenter) first brought before their notice the question of the reversible condenser; and he then pointed out the solvent power of their tar. Taking the temperature of the gas tar in the hydraulic main at 130°, he pointed out that it would dissolve 70 per cent. of its weight of naphthalene. He also suggested that, in the condenser, the excess of naphthalene over and above what the gas would carry at normal temperature should be taken out. Further, he mentioned that gas at the temperature of the hydraulic main—as it left the hydraulic main, and passed into the foul main—must carry more naphthalene than it would contain at normal temperatures; and when the temperature fell, this excess amount of naphthalene would come down somewhere. Moreover, he suggested that its removal could be economically effected by washing down the crystals charged with hot tar vapours in a reversible condenser. As he explained at the time, the condenser with which these experiments were made was very crude in form; and having the opportunity, two or three years later, of devising a better piece of apparatus, he availed himself of it, and a condenser as erected was described to the members. That condenser had been working for about fifteen or eighteen months, and in that time they had no difficulty whatever with it. The condenser was working to-day practically as he then described it. They had not opened it at all; they did not know what the interior was like, excepting that it gave no back-pressure. Well, it was thought that this experience was good enough to make a further experiment with this style of condenser. One of the most troublesome stations of the South Metropolitan Gas Company with regard to naphthalene had been Rotherhithe; and therefore it was thought that there would be a very suitable position to try a further extension of this method of condensing. Two condensers

were erected there; and they were put to work some time in the spring of the present year. They went on for a short period, but difficulties began to show; and it took them some little time to ascertain what those difficulties were due to. The chief difficulty was that, instead of the condenser clearing itself, as it should have done when it was reversed, it did not do anything of the kind. They reversed it in the usual way; but it did not get free. The pressure went on accumulating from day to day; and they had to take advantage of their Sunday stops to clear it out, and give it another start. It was very difficult indeed to know what was the cause of this, since the conditions at the Rotherhithe and Bankside works were, in many respects, very much alike—that was to say, exactly the same coal was being used. In order to get over the difficulties, the experiment was tried of introducing tar artificially into the condenser. It was felt that the reason of the condenser not behaving properly was that there was not sufficient tar to bring down the naphthalene in the condenser. So they first of all tried the experiment of carrying the pipes to the top of the vertical columns, and pumping in tar. He was very much opposed to this procedure. It did not fit in with his ideas of a reversible condenser. But at any rate it was carried out; and, on examining the tubes at intervals, he saw the experiment was a successful one. This being so, they applied the tar in a more scientific manner than pumping it in through a pipelet at the top of the column. At the top of each column, they provided a 1-inch pipe running horizontally across the centre of the tube, and this was perforated with holes $\frac{3}{16}$-inch diameter on either side; and they pumped in tar with a plunger tar-pump. This had got over the whole of the difficulty. The condenser was now reversed in the usual way; and it was kept as clean as the Bankside one. It was doing its work and a good deal more than its work. It was put up for 4 million cubic feet of gas; and it was doing 6 millions. It was, in fact, doing all the work that was expected of it. Now since this experiment, they had been endeavouring to find out to what cause was due the difference in the working of the two identical apparatus in these two different works. There was one striking fact with regard to the quantity of tar produced. At Bankside, inclined retorts only were in use, and it was a curious fact that the amount of tar produced per ton of coal in the inclined retorts was considerably higher than in the horizontal retorts. As a matter of fact, at Bankside it was from 10½ to 11 gallons per ton of coal carbonized. At Rotherhithe, the reverse was the case. They produced there the least amount of tar per ton of coal carbonized of any of the Company's stations. It was a little over 9 gallons. But they could not "eat their cake and have it too." At Rotherhithe, they were able to work horizontal retorts at a high heat, and the make of gas had been above 11,000 cubic feet per ton of coal; at Bankside, the make was 750 cubic feet lower. So that it was possible the reason of the apparatus acting differently in these two cases was that in the one there was sufficient tar going forward with the gas to keep the condenser clear on reversing, and in the other there was not, and tar had to be artificially added in the manner Mr. Glover had suggested. So much for that. Now he would deal with the proposal—and it was a very good one—of Mr. Glover for separating the tar produced in two stages of the manufacture. As he understood the authors, the suggestion was to separate the hydraulic main tar which was exposed to high temperature from the tar thrown down later on, and which would, of course, contain considerably more naphthalene. But he was not quite sure whether this was absolutely necessary. He could see it would be an improvement; but whether it was quite necessary he was not altogether prepared to say, because nine-tenths of the tar was already thrown down in the hydraulic main. There was already nine-tenths of the tar suitable for Mr. Glover's purpose. In his (Mr. Carpenter's) method of working, that would be diluted with the tar which was not so suitable. Of the two, Mr. Glover's system was undoubtedly the better, because he selected the tar which must have the smallest amount of naphthalene in it; and he used that for the purpose of removing the surplus naphthalene. The way he (Mr. Carpenter) had been doing it was to take the tar from the tar-well, and use it for the identical purpose. He was sure that this was the right line both Mr. Glover and he had been working on; and it did seem to him a pity not to take advantage of the solvent power from at any rate a portion of the tar. They knew the tar had the power of dissolving the naphthalene; and it was a great pity it was not more applied for this purpose. Apart from these, he did not know there were any other points he need detain the members with. The experience at Bankside was very interesting. It showed how very careful one should be in drawing conclusions. There were two works, in each case under the same conditions with regard to coal and subsequent treatment and working; and yet they got results diametrically opposed one to the other. The paper was an excellent one; and it showed the amount of care and attention that Mr. Glover had given to the development of this subject.

Mr. H. E. Jones (London) said, if he could not tell the members of works on a considerable scale which succeeded in supplying gas free from naphthalene trouble from the same coal as was used in London, he should, he believed, at any rate arrest attention by the statement that he knew of a works condensing the tar and gas together not by vertical condensers, but by one which was almost a horizontal condenser from top to bottom, that had no difficulty in respect to naphthalene. This was at Epsom; and by the mere fact that they condensed the gas and tar together, and part of the ammoniacal liquor, they had succeeded for the last twenty years, during which these works had been under his care, in avoiding the formation of naphthalene. Not only did they never get it on the works, but they did not get it in the district. Even in the case of lamps in outlying parts of the district, with ½-inch services 100 feet long, these services did not get stopped. The Company, in fact, had not a device in their possession for clearing service-pipes of naphthalene; and therefore he thought there was something to be said in favour of the form of condenser used on the works. He was not giving the members his opinion or the experience of a week or two, but an experience of years; and there was the fact that naphthalene was altogether unknown there. There was another element in the matter, which was that the illuminating standard for the gas was lower than that of London; and he had satisfied himself that, though he got rid of the naphthalene by this condenser, he also got rid of a fraction of the illuminating power that he would otherwise get. Might he express this in another way? He believed when he washed out the naphthalene, in cooling it out with the tar, he also unfortunately cooled out a certain amount of benzol vapour, which would otherwise give him a higher illuminating power in the gas itself. But against this reduction, which was undoubted, there was the compensation of the greater uniformity in the quality of the gas—there was less variation. Whether the tar in the condenser acted as a sort of magazine in another way, and would enrich the gas if it was deficient in hydrocarbon, and at the same time deprive it of any excess of hydrocarbon, of that he could only form an opinion. But the regularity of the illuminating power of the gas at these works had always been a great surprise to him. At the same time there was the fact. It was not exactly only a great surprise, but a great comfort to him that they had no trouble with naphthalene either on the works or in the district. He had often wondered whether this met with sufficient appreciation. He might say that at another works—at Watford—they had the same condensers, but they did not always use Newcastle coal; but they did for the most part use the coal that was used in London. And it was his impression that it was due to the condenser, in the case of Watford, that they had little or no trouble with naphthalene either in the scrubbers, purifiers, and gasholder pipes on the works, or in the consumers' services in the district. Now he ought not to sit down without referring to yet another matter. He was reminded of the fact that he had also stated, and had met with some amount of contradiction, that the action of water gas in reducing naphthalene was due, in his opinion, to very much the same thing. He might allude to an incident in support. At one time they started making a rather lower grade water gas, and economizing the oil in the Commercial Gas Company's district. Then they suddenly found what they had been free from for some years—since they commenced the use of water gas—and that was further evidence of napthalene. He at once increased the proportion of oil per 1000 cubic feet of gas made, by another ½ gallon; and this produced an immediate improvement. They reverted to the satisfactory condition of things that existed before. He should like to say, with regard to the Commercial Gas Company's district, that he believed the mere saving in the fitter's time in clearing out the service-pipes was worth the best part of £1000 a year to the Company. This would be a small price to pay, in his view, for the excess of oil necessary for the purpose. This was what he called the excess oil; and he must have traced in what he might call this supersaturation by oil of carburetted water gas some analogy to, or that it would have very much the same effect as, the process of spraying or forcing finely divided vapour of oil into the distributing mains. He thought they had in all these cases an oleaginous deposit which had a solvent action upon the naphthalene.

Mr. T. May (Richmond) asked whether Mr. Jones would tell them whether the quantity of gas produced per ton of coal at Epsom was about the same continuously, because he (Mr. May) thought a great deal depended upon that.

Mr. Jones: Roughly, yes. I should say 10,000 cubic feet, or within 2 or 3 per cent. of it.

The President: Is the coal used Durham?

Mr. Jones: All at the same time for years together, and then perhaps some other coal for years together.

Mr. D. H. Helps said his experience at Redhill agreed exactly with that of Mr. Jones at Epsom. They had high heats, and made close upon 11,000 cubic feet from Durham coal, and they never found any naphthalene on the works or in the district. They had a tar seal, and the gas and tar travelled together for a considerable distance before any tar was removed. Some was then taken away from a small pipe. They had no condensers proper—only a long length of foul main; and the gas travelled in one direction, and the deposited tar travelled back against the gas. If some of them would return to the older methods of working, and not separate the tar and gas so quickly, they would very likely find after a time—after the naphthalene had been picked up from the mains—that it would be a possible solution of the naphthalene difficulty. Anyway, they never saw it at Redhill, though their heats were high, and their make a big one.

Mr. Frank Prentice (Ipswich) said this subject was one that interested him a great deal. He was especially interested in the further description which Mr. Carpenter had just given as to his reversible condenser. At Ipswich, they at one time condensed their gas on the draft side of the exhauster; and the condensers were in a constant state of block. Almost every Sunday it was

necessary to do something during the winter to clear them out. It was then thought that it would be a wise thing to put them on the pressure side of the exhauster. This was done; and at the same time they turned them into reversible condensers. Just at first, they were changed every week; but after a time the outlet of the boxes at the bottom, which perhaps were somewhat small—3½ inches—blocked up pretty frequently, though the condensers themselves remained quite clean. The next move was to change them more often. They did this for the first little while twice a week, afterwards every other day, and the gas was made to flow in different directions through the condensers. Since that time they had been absolutely clear. Only as late as the previous Sunday the 6-inch drain-pipe which drained the boxes at the bottom, where a good deal of blockage formerly took place, was opened as a precautionary measure before the winter's work fully set in; and it was found to be as clean as the day it was put in. Their experience at Ipswich had been this: Although the condensers had not blocked up with naphthalene—had not taken the naphthalene out of the gas, only a proportion of it—the Livesey washers which came next were frequently blocked with naphthalene; and, during the last few months, they had had (perhaps he might say) more naphthalene in the town, in the fittings and services, than they had ever known in the history of the Company—at any rate, for the last twenty years during which he had been connected with the Company. It seemed to him to be a question whether it was not better to let the naphthalene come down where they could reach it readily, than get it in the services and meters where it caused great annoyance to people, and where it was more costly to remove. [Mr. CARPENTER: Hear, hear.] Going a little back (perhaps he should have mentioned this first), they had made some considerable experiments in washing gas with an oil (it was got from the tar distillers) comparatively free from naphthalene, and they were enabled to raise the naphthalene in the oil up to about 45 per cent. This they had tried for some time; but on two occasions, they had found that apparently (he should not like to speak definitelyon the point) the oil had gone forward into the purifiers. It had not affected them apparently so far as sulphuretted hydrogen or carbonic acid was concerned; but it appeared, after a time, when the whole series of boxes had been changed, and they had had their turn at being first to receive the gas, that their work as sulphur compound purifiers had been seriously impaired. He was not prepared to say that it was the oil; but he had a strong suspicion that it had something to do with it. At any rate, when this unfortunate position had arisen (the gas was tested severely in Ipswich—it was tested nearly every day, without notice), it had been rather embarrassing sometimes, and the remedy had been on both these occasions to stop the oil. This brought him to the point as to the class of oil that should be used. Some time ago, there was a suggestion made that blast-furnace oil should be used, which could be procured at some low figure—about 1d. per gallon. Could Mr. Glover enlighten him at all as to the value of that oil, or whether he had made any further experiments with it? Everybody would admit that a gas would carry a certain amount of naphthalene—at times it carried it all, and there was no naphthalene found anywhere; at other times, they had a small or large quantity deposited. Now was it not possible to add to the gas a carrier which would carry the extra naphthalene with the gas, and so avoid its being deposited? At the present time, they were, at Ipswich, putting in a certain quantity of 90 per cent. benzol, as free as possible from sulphur, for this purpose; and although the experiment had not been running more than a week, they had improved—a little effect was being produced—and he was hoping, if they kept it on for a month or so, they would get some improvement in the ordinary mains and services.

Mr. J. L. CHAPMAN (Harrow) said that, having had much trouble with naphthalene, and having made great changes in the works lately, it might be of interest to give some account of the experience that had come to them. They had an old condenser in the days when, he thought, the condensing was about one-third of the present quantity they had now. During the time they were increasing the make of gas, they had never known what naphthalene was; and it was only within the last four or five years that naphthalene began to appear by degrees in the district. But they had never found any—had no knowledge of that digging out of naphthalene, or having it about the works in any quantity—except a little showing in the inlets of the gasholders as a milky substance. But they were greatly troubled with it in practically all the cocks of the lamps—nowhere else to any extent, except a little in services where they crossed areas, or where there was some other exceptional reason for it. However, since the alteration to larger condensers, they had practically had no trouble with naphthalene, save on one occasion, which perhaps showed the accumulation of naphthalene was in the gasholders, and it came out upon the first opportunity it had of getting away. One Sunday night, the gasholders were down very low, and on that particular occasion—coinciding practically with the time the gasholders were down—a great number of the lamps were stopped in the cocks by naphthalene. But during the time since the new condensers were erected, they had not been troubled with naphthalene at all.

Dr. HAROLD G. COLMAN (Birmingham) said it gave him great pleasure to be present to hear a further contribution from Mr. Glover, on behalf of himself and Mr. William Young, to the valuable series of papers they had given in this connection. Of course, there were so many things one might say on this question, that perhaps he (Dr. Colman) might confine himself to one or two points in connection with the utilization of the solvent oils that were present in, and which they manufactured with the coal gas, for the thorough extraction of the naphthalene. With Mr. Carpenter, he had always believed that it was possible, by means of suitable arrangements, to so utilize these oils as to get practically the whole of the naphthalene drawn from the gas, and that it was only a question of finding out what was a suitable arrangement. In considering the question of the naphthalene trouble, he thought they must divide works up into two classes—the class that were using only Yorkshire, Derbyshire, and similar coals, and the works that were using Durham coals. There was no doubt, he thought, that the difficulty in the case of Durham coal was very much greater than in the case of those using other coals. Dealing with Yorkshire and Derbyshire coals, most works he knew of in which these coals were carbonized had no difficulty whatever with naphthalene during the winter time—at any rate it was most exceptional. That was to say, the condensers, as used in the ordinary manner, were quite sufficient in the winter to keep the naphthalene sufficiently low to cause no trouble from deposition in the services. So far as their experience in Birmingham was concerned, they found that actually the amount of naphthalene in the gas in the winter was very low—not more than from 2 to 4 grains per 100 cubic feet of gas. With that they did not get any trouble. Therefore, if under the winter conditions, they were able to keep their naphthalene as low as that, and cause no trouble, it was manifest that, if they only modified the thing in the right way, and reproduced the winter conditions in the summer, they would be as well off then in regard to naphthalene. It was the alteration of the conditions in the summer which brought about the rise in the quantity of naphthalene and the trouble in the services. They never had any trouble in the manufacturing plant at the works in Birmingham; it was only in the district, and this, he believed, was generally the case where Midland coal was used. One point in which the summer conditions differed materially from the winter ones was in the rate at which condensation was effected. In summer, it was generally necessary, although the make was much smaller, to have the full condensing area on; and therefore, during that time, they had the gas passing very much more slowly through the condensers, and at the same time they had a much smaller quantity of tar or oils coming down in the condensers. Therefore the oils which were first separated in the form of a fog, must be more sparsely distributed in the condenser. Besides this, in winter the condensation was quicker, while in the summer it was much slower. It was therefore to these two conditions that existed in the winter that he thought the more complete removal of the naphthalene in the summer was to be looked for. That was to say, the slow condensation (contrary to the usual acceptance) was against the removal of the naphthalene; and to that extent therefore this agreed with what Mr. Carpenter advocated in his paper as read before the Association last year. The danger of the quick condensation, it appeared to him, was that, if they commenced it too soon, the heavy tars still contained in the gas were able, as the temperature went lower, to absorb more benzene than if they were removed at a higher temperature, with the result that the illuminating power of the gas was lowered. Therefore, the preliminary step to quick condensation was the removal, as completely as possible, of all the heavy tars before the condensation proper commenced. It was with this object in view that he had recommended the use of some form of tar separator. The separator he had suggested was a centrifugal one; and it was on account of the extreme simplicity of the apparatus, and because it threw no back-pressure, that he recommended its use.* The removal of the heavy tars was advised from the view of naphthalene recovery, because otherwise the light oils (containing the best naphthalene solvents—viz., xylenes and toluenes) as they separated coalesced with the heavy tars being carried forward; and as they travelled along, and got to the cool end of the condenser, they were already very nearly saturated, and were not able to take up as much naphthalene as they would have been had the heavier tars been removed beforehand. It seemed to him, therefore, possible to so arrange the condensation, in the case of all coals other than Durham coal, without very much alteration, so that the whole of the naphthalene would be removed, as the proportion of light oils per ton of coal was very much greater than in the case of Durham coal, while the amount of naphthalene was smaller. To deal with Durham coal, a different set of conditions would probably be necessary. He agreed with Mr. Glover that the amount of light oil in the case of Durham coal was not sufficient of itself to remove the whole of the naphthalene. Consequently some plan must be adopted to circulate the light oils through the condenser a second time. They would have, in the process of condensation, a stream of gas coming from the retorts containing an amount of light oils that had been made from the coal. They must get these light oils or the tarry oils in some form or other from the tar, and return them to the condenser at a suitable point in order to bring up the proportion of the light oils to the right quantity. He (Dr. Colman) had tried several ways of doing this which had been successful on a small scale, but was not yet able to say if they could be equally well employed on a manufacturing scale. There was

* See "JOURNAL" for June 3 last, p. 1487.

one remark made by Mr. Jones with regard to the naphthalene in water gas. He (Dr. Colman) might say that their experience was that the amount of naphthalene in water gas very largely depended upon the candle power at which they were making it. If they were making 16 or 17 candle power water gas, the naphthalene might easily be as high as in coal gas; but if they were making a 21 or 22 candle water gas, the quantity of naphthalene rarely rose much above 2 grains per 100 cubic feet. When a rich 20-candle power coal gas was made, there was rarely trouble with naphthalene, owing to the amount of light oils that was produced; and he thought it was the same in the case of water gas—if they were using a quantity of oil sufficient to give (say) a 21-candle gas, the amount of tar oils simultaneously formed was sufficient to wash down the naphthalene in the condensers. But when they got down to 16 or 17 candle power water gas, the quantity of oils produced was insufficient to reduce the naphthalene to a low limit. He had known as much as 10 or 12 grains of naphthalene in a water gas of 16 or 17 candle power; but in a gas of 20 to 21 candles, it was somewhere about 2 grains.

Mr. J. W. Helps (Croydon) said one remark made by Dr. Colman at the end of his speech reminded him of some experiments they had lately been making with regard to the amount of naphthalene in water gas. They made a gas generally between 19½ and 21 candles; and the average amount of naphthalene they got varied between 1 and 2 grains per 100 cubic feet. Then, again, it was stated that the conditions for the abstraction of naphthalene in a water-gas plant were not so satisfactory as was the case in connection with coal gas. This, again, seemed to be borne out by his (Mr. Helps's) experiments and experience, which showed that the tar itself taken from the water-gas apparatus contained absolutely no naphthalene at all; and it seemed to him that whatever naphthalene was made in the water gas passed forward without any change or alteration due to its abstraction in the plant itself.

Mr. C. F. Botley (Hastings) said the very admirable paper they had had that day was founded on such laws that there could be no doubt as to their accuracy, and had it been before him some years ago it would have been of the greatest possible assistance. He had to seek a remedy in other directions; but the process with which he was identified did not arise out of the present paper. It appeared to him Mr. Glover had put his finger on the two main points. First of all, there was the proportion of solvents that a given coal would produce, and the way in which these solvents came in contact with the gas. If means could be obtained whereby these two could be mutually applied, there was no doubt as to the efficacy of the methods Mr. Glover advocated. The difficulty was in finding out how, in each individual case, it was to be done. In the new works for the Hastings Gas Company now under construction, many of the processes that Mr. Glover and gentlemen associated with him had so admirably expounded, would be taken advantage of. The process, which he might allude to as the Hastings carburation process, was only instituted to overcome a very grave difficulty. But it was some source of gratification to him to know that it had succeeded in abolishing the difficulty in a great many places. While they were all of them striving after a high ideal, it was a remedy that anybody could apply at a very insignificant cost. He should like to ask Mr. Carpenter whether his reversible condenser answered in the district. He presumed, from his eloquent "hear, hear" just previously, that it did. It seemed to him (Mr. Botley) to be an important point relating to the reversible condenser, as to whether, if it was efficacious, there would be any trouble in the district.

Mr. Carpenter said he might answer that question at once. They had been using the reversible condenser on only 4 per cent. of their total make, and he need not say that, under these circumstances, they could not expect to look for very much of a reduction of the complaints in the district. He could, however, say this, that since they started the condenser at Rotherhithe, they had reduced the complaints considerably in that area. They used to have there from 200 to 250; and it was about half that number now. This might or might not arise from other causes; but he should not be happy until they did away with naphthalene complaints altogether—whether by reversible condensers, or other ways.

Mr. Glover said it was not his intention to occupy much time, except to express his very great thanks to Mr. Carpenter, especially for his high appreciation of the efforts that had been made towards the elucidation of the matter before them, to the other gentlemen who had so very kindly spoken, and to all for the patient hearing they had given him. It would be noticed that this was not a paper simply prepared by himself; but there was the name of Mr. William Young connected with it. If it had not been for Mr. Young, he (Mr. Glover) would not have been present to read the paper; and he would not have had half the knowledge that he thought he possessed that day on this subject without Mr. Young's very great prompting and (he thought he might also say) tuition. Mr. Young was specially fitted, by his training and long experience, for dealing with gas and oils and solvents on a very large scale, and to deal with a subject of this kind. And he (Mr. Glover) was very thankful that it had fallen to his lot if to do nothing more than edit the copious notes which Mr. Young supplied to him as the foundation for the present paper. Therefore, if a vote of thanks was passed, he should like it to include the name of Mr. Young, and that the Secretary should convey the thanks of the Association to him. Mr. Young had no interest in this matter, except that he wished to be helpful to the industry with which he, at one time, was closely associated. In his retirement, he gave a good deal of time to the thinking out of these problems, and he helped one to put them into shape. He (Mr. Glover) did not think that he need go through all the points raised in the discussion; but perhaps Mr. Prentice's remarks called for some reply. In the case of washing with oil, with which he understood Mr. Prentice had been experimenting for some time, he found what he believed was oil vapour going forward from the washers, and stopping the action of the lime on the sulphur compounds. Well this depended entirely on the specific gravity and the nature of the oil Mr. Prentice was using. If it contained any spirit which could be carried forward, then possibly he might have some carried forward to the purifiers; and it might have the action he had mentioned. With regard to the use of benzol (and this rather gave them a clue as to his trouble with sulphur compounds), they all knew that it was a matter of great importance to watch the quality of the benzol. It was to the interest of tar distillers to put as much carbon bisulphide in the benzol as they could. They did not know how to get rid of it. Rubber manufacturers refused to take it; and if the distillers were not watched closely, they sent out benzol for gas enrichment purposes with too much sulphur in it. This affected very rapidly the amount of sulphur compounds in the finished gas. So that he (Mr. Glover) just threw this out as a hint, that the sulphur compounds might be partly due to the benzol that Mr. Prentice might have been using from time to time. Dr. Colman had said that there was no trouble where Derbyshire or Yorkshire coals were used—he thought he said in winter time. [Dr. Colman: Yes.] Well, he (Mr. Glover) had had experience with these coals for six or seven years, and could bear out largely what Dr. Colman said—that the chief trouble was in summer. But it was not entirely true that there was no trouble with naphthalene in the winter time, because a good deal deposited in the works connections in the winter time. He had known in meter and holder connections a very material deposit in the autumn and winter; and afterwards, in the warmer weather, it was sent forward into the district by revolatilization. This was simply because the naphthalene was not removed from the gas by any of the ways that had been suggested. It was just allowed to go on depositing "in its own sweet way." Before he took charge of his last works (in the Midlands), they had had tremendous trouble with naphthalene. The trunk-mains had been stopped. Expert advice had been obtained from wherever they could get it; and they had even gone to the extent of sending men down the inlet and outlet pipes of the holders to clear them out. Well after the introduction of the volatilizing process (which was an extremely simple one for giving to the gas what Dr. Colman had described as a "fog," artificially produced from suitable oils), all these deposits about the holder and meter connections and the trunk mains were swept away and seen no more; and there was no doubt that it could be done in a simple fashion. It was only a question with those who were troubled with naphthalene whether they applied a volatilizing process (which cost very little, and occasioned but little trouble to send the solvent wherever the crystals would form), or whether they would do it in the more thorough way, by washing out the naphthalene just as they washed out ammonia. The object of the paper was to suggest how the washing out could be accomplished by the crude oils that were produced, and which they generally called tar. It had been to him a most gratifying discussion; and the evidence it afforded went to show that they were making real progress and getting on towards a proper understanding of this most perplexing subject.

On the motion of Mr. J. Tysoe (East Greenwich), seconded by Mr. G. R. Love (Guildford), Messrs. Young and Glover were heartily thanked for their paper.

The Naphthalene Investigation.

The Hon. Secretary said it was necessary he should at this point make one or two remarks with regard to the naphthalene investigation undertaken by the Association, because very ittle had been said or published about it lately, and the members might think the subject was practically at a standstill. He, however, could assure the members that it was not so. The Sub-Committee had been holding meetings, and the matter had been kept very prominently before them. The members themselves would know that the Sub-Committee had not been idle, because recently every member would have received a copy of a circular the Committee were issuing which had taken some time to formulate, and this practically was the reason they had been so long about it. So far, about 57 of the members had returned their circulars, with the information asked for very carefully filled in. There still remained, however, about another 100 to be returned. If any were present who had not returned them, he hoped they would do so as early as possible, because it was the intention of the Committee, as soon as they were received, to obtain the assistance of an expert, to place the circulars before him, and get him to put the information together, and sift it down. Afterwards, possibly, some few works having naphthalene, and some few having none, would be carefully examined, and tests made which would, he thought, help them as much as possible in their endeavours to get to the bottom of this puzzling subject. The

question was therefore, when would the members send in their papers to enable the Committee to make a good and fresh start on the subject.

THE ESTIMATION OF NAPHTHALENE IN GAS.

By the aid of a set of the appliances, Dr. Colman at this point interested the members with a description of the system of naphthalene testing with which his name and that of Mr. J. F. Smith are associated.

The PRESIDENT, in a little introduction, said the apparatus before them was designed by Dr. Colman and Mr. Smith; and, when it was decided that the question of naphthalene should be brought forward at this meeting, he (the President) felt very strongly it would be a good thing to have the apparatus for the testing of naphthalene before them, and to have a description of it from Dr. Colman himself. He was extremely pleased that that gentleman had been able to be present.

Dr. COLMAN, in the course of his description, said that he did not propose to give an exact detailed account of the method which he and Mr. Smith had adopted for estimating naphthalene in gas, but to give a general account of the principles involved and of the apparatus employed—the details having been already published.* They had tried a large number of substances as absorbents unsuccessfully, but had finally found a suitable one in an aqueous solution of picric acid. It had long been known that this acid combined with naphthalene to form naphthalene picrate; and a mixture of the acid and sawdust had been successfully employed for the removal of the hydrocarbon from coal gas. But the cost of the method was prohibitive on a large scale. The principle of the method was analagous to that employed for the estimation of ammonia in gas, in which the gas was passed through a standard solution of sulphuric acid, and the quantity of ammonia absorbed calculated from the amount of sulphuric acid neutralized. In place of the sulphuric acid a standard solution of picric acid was employed, and the quantity of naphthalene calculated from the amount of picric acid neutralized. Owing, however, to the fact that the combination of naphthalene and picric acid was much more feeble than that of sulphuric acid and ammonia, the analysis could not be carried out in such a simple manner. In making a test, the gas was passed through a series of three bottles containing a known quantity of standard picric acid solution; the naphthalene being almost entirely retained in the first bottle—only traces getting forward into the remaining two—and, when a sufficient quantity of gas had passed, the contents of the second and third bottles were washed into the first. Unfortunately, the precipitate formed did not consist of pure naphthalene picrate, but of a mixture of it and free naphthalene. Before proceeding further, it was necessary to convert the whole of the naphthalene into the picrate. In order to do this, a method was followed which was proposed about ten years ago by Küster for estimating naphthalene in mixtures of hydrocarbons. The bottle was closed with an india-rubber stopper, through which passed a glass tube closed at the lower end, but having a small hole blown in the side about an inch from the bottom. This tube was placed so that the hole was just below the bottom of the stopper; and the bottle was then evacuated with a water-jet pump. While the pump was still working, the tube was raised so that the hole was well above the bottom of the stopper—thus sealing the bottle. The bottle might then be safely heated in a water-bath without fear of bursting it, or of blowing out the stopper. The heating was continued until the whole of the naphthalene was dissolved, and the bottle and contents were allowed to cool, with occasional shaking. After standing for a few hours, or preferably over night, the separation of naphthalene picrate was complete; and this was then filtered off with certain precautions, and the amount of picric acid left in the solution determined by titrating an aliquot portion with decinormal soda. The difference between this and the quantity of picric acid in the solution originally taken represented the amount of picric acid which had combined with naphthalene; and as 229 parts of the former combined with 128 parts of the latter, the amount of naphthalene in the volume of gas passed was readily calculated. In order to minimize calculations, a special graduation had been introduced on the burette used for the titration, which, if specified conditions as to the quantity of solution and gas passed were fulfilled, gave, by direct reading, the number of grains of naphthalene in 100 cubic feet of gas. A difficulty sometimes arose from the fact that the gas pressure was not high enough to force a stream through the series of bottles employed. Where holder pressure was available, this was usually sufficient; but this was not the case with the ordinary town pressure. In order to carry out the test with any pressure of gas, the test-meter used was enclosed in a second case, and a partial vacuum created in the case and outside the meter by means of a little water-pump, which drew the gas from the main through the bottles and through the meter. As the whole of the meter was exposed to the partial vacuum, its correct registration was in no way affected, although, in making the usual correction for temperature and pressure, allowance must be made for the difference between the pressure within the case and that of the atmosphere. This was shown by means of a U-tube containing mercury, one limb of which was in communication with the interior of the case, and the other open to the atmosphere. Into the latter limb, a tube dipped, which was also connected with the interior of the case, so that, when the mercury level fell below the bottom of the tube, air was drawn into the case and prevented the vacuum rising any higher. By this means the vacuum was maintained constant; and, further, any desired vacuum could be obtained by altering the position of the tube in this limb. The meter was also very useful in making tests with the crude gas before the exhausters where it was under vacuum. If the gas being tested for naphthalene contained any ammonia, the latter would neutralize some of the picric acid, and would, therefore, cause the result to be too high. To avoid this error, the gas, before meeting the picric acid solution, was passed through a dilute acid, preferably oxalic acid, as sulphuric acid might possibly absorb some naphthalene. In order to check the accuracy of the method, a number of trials had been made, by subjecting gas or air containing known quantities of naphthalene to the test, and an extreme variation of 3 per cent. from the true value was found. Subsequent experience had confirmed this so far as purified gas was concerned. With regard to unpurified gas, his own experience was that the method gave accurate results; but he understood that in some works it had been found that, while satisfactory results were obtained with the purified gas, the test failed with the crude gas. Probably this was owing to the fact that the gas from some coals contained a small quantity of a compound which affected picric acid, but which was removed with the other impurities in the subsequent purification process. It was therefore necessary to be cautious in applying the test to crude gas. He had often been asked whether the test could be modified so as to test the amount of naphthalene in the gas at the inlet to the condensers; and he was sorry to say that so far he had been unable to do so. The difficulty lay in the fact that the gas must be cold before passing through the picric acid solution, otherwise the naphthalene was not absorbed. If a sample was taken from the condenser inlet and cooled, tar containing naphthalene separated out from the gas before it reached the picric acid, and the result was quite fallacious. From the description, it would probably appear that the test was rather lengthy and complicated; but, as a matter of fact, although the time which elapsed between the start and finish of a test was considerable, this was due chiefly to the time taken to pass a sufficient quantity of gas, and then later to allow of the complete cooling and separation of the naphthalene picrate. When once the apparatus had been fixed, the time taken in setting the test on, preparing the solution for heating, and finally the titration, was not great, and the manipulation in each case was very simple. Of course, in this, as in other tests, a little practice was necessary to carry it out efficiently. If, however, some means could be devised of causing the naphthalene picrate to come down in the solution unmixed with free naphthalene—thus avoiding the intermediate heating process—it would greatly simplify the test, and reduce the time required in completing it.

The PRESIDENT said many of the members had tried this test; and he had heard there had been difficulties. Though Dr. Colman's explanation had been a thorough one, if there was any point that occurred to members, they would do well to take this opportunity of putting questions.

Mr. J. TYSOE (East Greenwich) said he understood Dr. Colman to say it was necessary to leave the bottles standing to the following day. At East Greenwich, they made these tests; but they had not carried them out in that particular. He should like to know whether this made any considerable difference in the results arrived at.

Dr. COLMAN said he might say at once it was generally preferable to leave the bottles as recommended. He had tried them at shorter periods, and found very little difference; but, as a matter of fact, if they did not want the result particularly, it was better to leave the bottles standing. However, if they allowed them to get completely cool (it took about two hours generally) the error was not very serious.

Mr. CARPENTER (invited by the President) said he did not think he could add anything to Dr. Colman's clear description of the test. They, as gas engineers, were indeed much indebted to this method for throwing some light on the darkness appertaining to naphthalene.

The PRESIDENT said he could thoroughly recommend this test to all; and he was sure it would open the eyes of many gas suppliers to the condition of their gas. The apparatus looked somewhat formidable; but in many cases it was not necessary to use the meter where the pressure was sufficient before the holders. It was, however, a useful adjunct where there was any difficulty in that respect.

On the motion of the PRESIDENT, seconded by Mr. C. F. BOTLEY, Dr. Colman was heartily thanked for his description.

Dr. COLMAN said he could only thank the members very heartily for the kind way in which they had accepted the vote. It had been a pleasure to him to attend the meeting to describe the test, and to hear the paper by Messrs. Young and Glover.

This concluded the meeting.

Tea was afterwards served, and a couple of hours were pleasantly spent in social intercourse.

* An illustrated description of the apparatus employed appeared in the "JOURNAL" for March 27, 1900, p. 798.

COKE CONVEYING AND BREAKING PLANT AT THE OOST-ZEEDIJK GAS-WORKS AT ROTTERDAM.

The following is an abstract translation of a description of new coke conveying and breaking plant at these Rotterdam works, which has recently been given in "Het Gas." For the illustrations accompanying it we are indebted to the courtesy of Heer Bolsius, one of the Editors of that paper.

The Town Council of Rotterdam, at their sitting on the 15th of November, 1900, voted the sum of 4,200,000 florins (£336,000) for the extension of the gas-works at Oost-Zeedijk, in order to raise their productive capacity from 706 million, to 1765 million cubic feet per annum. The extensions had to be carried out on the site of the existing works, and it was necessary to make the most of the small space available. The costly manner of transporting the coke by wheelbarrows, which had been hitherto practised, was also to undergo a radical change. The coke-breaking place was to be done away with, to make room for a water-gas installation, and a new coke-breaking apparatus, occupying as little space as possible, was to be erected. The plans for the extension, therefore, included arrangements for mechanically removing, breaking, sorting, and raising the coke. The first thing was to remove the coke from the retort-houses to a central point, and after dealing with it there, to transport it to its various points of destination. The scheme was divided into three sections.

(1) *Removing the Coke from the Retort-Houses to the Central Point.*—For this work attention was at once turned to the De Brouwer conveyor, already in use in many other places. By means of these conveyors the coke was to be carried from each of the four retort-houses to a space between them, where it was to be quenched in a transverse trough, and afterwards transported to the central point by means of a conveyor running over the main road on the works at an angle of about 30°.

(2) *Dealing with the Coke.*—The coke was to be dealt with in an iron building with a stone floor, on a pile foundation, to be erected at the central point. In this building the coke would have to be broken, screened, and made quite ready for retailing. Two gas-engines would be erected in the building, to supply the power for the various appliances, while space for an office had also to be left available.

(3) *Transferring the Coke to its Different Destinations.*—These destinations would comprise: (*a*) Storage places in two different parts of the works; (*b*) the water-gas plant which was to be erected; and (*c*) a receptacle over the railway viaduct.

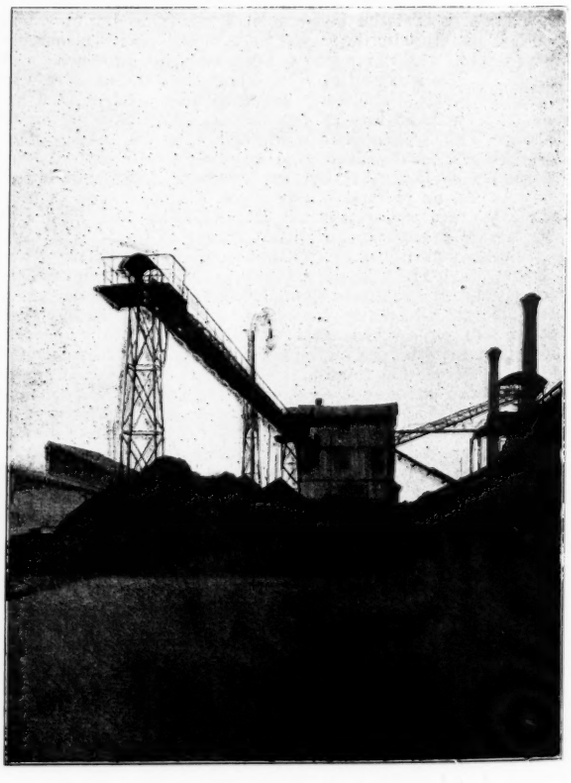
The object of the central position was to enable the transport of the coke to be controlled by as small a staff as possible, and the course of its removal from the retort-houses to the different destinations to be directed or altered from one spot. For conveying the coke from the distributing point to the different destinations, the so-called "crab" conveyor was kept in mind, because it is much used for conveying coal. The object of carrying the coke to the storage receptacle over the viaduct was to enable it to be loaded direct into the trucks, to be forwarded by train to the landing-stage at the works, where it could be put into lighters, for conveyance to the water-gas works at Feijenoord or elsewhere.

The capacity of the apparatus was calculated on the assumption that the maximum output of the coal-gas works would require 111,220 tons of coal per annum; and from this at the most 53 per cent., or 58,946 tons of coke (equal to about 4,118,000 bushels), would have to be removed. The maximum quantity to be conveyed away in 24 hours was taken at 295 tons, or about 12¾ tons per hour (equal to about 900 bushels per hour).

After the required sum had been granted, negotiations were begun with the Berlin-Anhalt Engineering Company, Limited, of Berlin, respecting the delivery and erection of the apparatus, with the result that on March 15, 1901, a contract was concluded by which this Company undertook to have the plant delivered ready for work before the winter of 1901-2. As already stated, it is intended to have four De Brouwer conveyors in the retort-houses, which will discharge the coke into conveyors lying between the retort-houses. The first-named conveyors, however, must be put off until the present horizontal retorts are replaced by inclined ones; so that the part of the project mentioned under the first heading—viz., conveying the coke from the retort-houses to the central point—has up to the present only been partly carried out. At present, the coke is removed in barrows to the De Brouwer conveyor, in which it is quenched by means of a water-pipe fixed to the trough. It is then conveyed to the central point, and the coke breaking and sorting house.

The trough runs partly horizontally until beneath the railway viaduct, which passes in front of the retort-houses. It afterwards runs at an angle of about 30° over the roadway to the coke breaking and sorting house. In it there is an opening with a funnel-shaped outlet, which can be closed by a sliding door through which the coke falls into the coke-breakers. This funnel-shaped opening to the breakers has two outlets, which can each be closed separately, so that the breakers can work either together or (in case of repairs) one at a time. The coke is discharged from the breakers on to the screen, which hangs on wooden spring supports, and sorts the coke into four sizes. Each size falls into its own receptacle; and each of the receptacles has at the side an outlet which can be closed by a sliding door and used for filling sacks. Thus all the coke so dealt with serves for the retail trade.

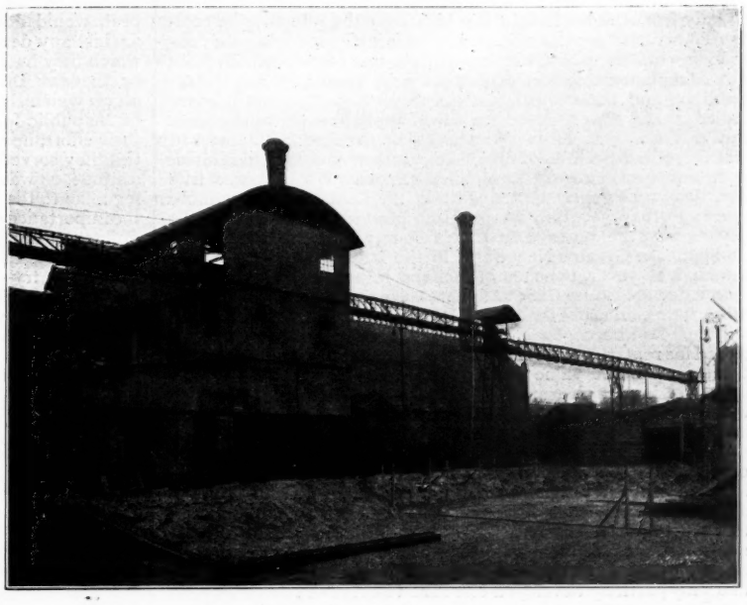
When the coke is to be taken unbroken to the storage places on the works, or to the store above the railway viaduct, it passes through an outlet higher up the trough, directly on to the upper screen without being broken. This screen sorts the coke into the same sized pieces as before, and the four kinds fall through separate funnels into the corresponding reservoirs before



mentioned, while the larger coke remains on the screen. By means of a flap in the lowest part of the screen, it is possible to let the coke drop, as desired, into (1) the "crab" conveyor, (2) the "crab" conveyor, placed at right angles to the direction of the screen, or (3) the projected De Brouwer conveyor (which was to have been finished last month) leading to the water-gas plant now being erected.

The "crab" conveyor takes the coke to the store above the railway viaduct, whence it can be directly despatched in railway trucks. The transverse "crab" conveyor serves for transport to the storage-places on the works. Having regard to the position of these storage-places on both sides of the breaking and sorting-house, this "crab" conveyor can, by means of intermediate gearing, be moved to the left or right as desired, so that the coke either falls on to one of two "crab" conveyors, to be moved further by one of them. The conveyors are provided with outlet openings with sliding doors at intervals of 6 ft. 6 in., so that it is possible to drop the coke out from them at any desired spot on to the ground.

In the construction of the breaking and sorting-house, allowance has been made for a vertical bucket elevator being provided later when, owing to larger demands for broken coke, it may appear necessary to pass the larger coke through the breakers, and sort it, as described above, into four sizes for retail trade. For driving the apparatus, there are in the engine-house two Deutz gas-engines—one of 25 and the other of 16-horse power. The former is for driving the whole apparatus when it is fully at work in the daytime; the latter for night work, when the coke will only be stored on the ground.



AMERICAN GASLIGHT ASSOCIATION.

The President's Address.

In the last issue of the "JOURNAL," we gave a short account of the proceedings at the thirtieth annual meeting of the above-named Association, held in New York last month under the presidency of Mr. W. R. Beal, and the text of probably the most interesting paper read on that occasion; the subject of inclined *versus* horizontal retorts being one upon which very diverse views are held by gas managers in the United States. This topic was a prominent one in Mr. Beal's address, he having completed an installation on a fairly large scale at the works of the Central Union Gas Company of New York City, of which he has charge. As mentioned last week, the address contained several matters of interest, apart from this; and we are now able to give an indication of some of them from the text which appears in the last number to hand of the "American Gaslight Journal."

The President began by congratulating the members on their good fortune in meeting in a city so full of interest to all engaged in the gas profession as New York, where the problems of competition and combination, of municipal privileges and interference, and of taxation for franchises for City and State purposes, were as numerous, as perplexing, and as indefinite as might be found in any other city of the world. He reminded the members that the Association had held seven meetings in the city since its organization in 1873. When they met there in 1899, the Companies then supplying gas were carrying on a fierce competition. The nominal charge was 50c. and 65c. per 1000 cubic feet; but the rate in competing districts was such as could be readily made by keen traders. The present was the first time they had found their business managed without the embarrassments of friction, and the wastefulness of competition.

These remarks served the President as an introduction to the following particulars as to the gas supply of the city: The first Gas Company to do business in New York was organized in 1823. Since that date, 25 Companies have built plants and carried on business in the territory now known as Greater New York. It may be fairly assumed that the business is in so assured a position that it can claim, and will secure, such judicial consideration and wise management that it will permanently meet all the needs of our growing Metropolis, and be satisfactory alike to owners and citizens. The erection of hastily-designed plants —the usual result of competition—has operated somewhat to prevent the construction of so complete and comprehensive a plant as the great and constant growth of the Metropolis would warrant. The Consolidated Gas Company have, however, with great wisdom, secured a large and admirably located site; and this is being prepared for the erection of buildings and apparatus now being designed by its able Engineers, for the major part of the supply of the great city. When the Association holds its next convention here, its members will be able to visit and examine one of the largest plants in the world, which, in the arrangement and character of its buildings, and in the efficiency of its machinery and apparatus, will be as complete as the state of the art and the use of resources can make it.

The President went on to refer to the invitations which had been sent to the members of the Association to visit the various gas and electric light stations in the city. This would, he said, give them an opportunity of seeing the most recently built, improved, and up-to-date station devoted entirely to the manufacture of water gas, and having a daily capacity of 25 million cubic feet. At this station, which had the greatest capacity of any of its kind in the world, would be found in use the best methods, appliances, and machinery adapted to the business. It was here that the first 5 million cubic feet gasholder in the United States was erected, and it was to-day the only holder in America rising above the guide-columns when filled. At another station there were in process of erection two stacks of inclined retorts; this being the third practical adoption of the system, and the largest installation in America. One stack was being put up by Messrs. Bartlett, Hayward, and Co., the agents of manufacturers of fire-brick material at Stettin. The retorts were 18 feet long and 25 inches wide, tapering to 23 inches at the upper end, and $15\frac{3}{4}$ inches high inside. The other stack was being erected, with all American material, by the Laclede Fire-Brick Manufacturing Company, of St. Louis. The retorts would be 20 feet long, 26 inches wide, tapering to 25 inches at the upper end, and 18 inches high. These were larger than any that had ever been used in settings on the inclined system. It was expected that each of these large retorts would carbonize 1000 lbs. of coal in four hours, and make (say) 30,000 cubic feet of gas per day, or from 250,000 to 275,000 cubic feet of gas per day per bench of nine, in actual practice.

Mr. Beal then proceeded to relate his own experience in connection with the system of retort-setting of which he had been speaking. He said he took up the subject several years ago, and endeavoured to introduce inclined retorts in the works of the Company of which he was Manager. But considerations growing out of the patent rights, &c., caused delay; and five years ago the sole management passed out of his hands by the sale of the plant. As the result of investigation into the merits of the system, he was favourably impressed with the German setting, except in respect of the length of the retorts. These he insisted should be not less than 18 feet long, and as large in section as experience in Germany determined was practicable. Influenced by this demand, retorts 18 feet long were tried at Posen; and they made so good an impression that the Stettin people submitted an acceptable offer to his Company, which had the approval of the Engineers of the parent Company, and the work was now, as already stated, in progress.

The President went on to lay stress upon the necessity for properly ventilating a retort-house, the difficulty attending which becomes greater as the quantity of coal carbonized increases. This is a matter of primary importance in a house furnished with inclined retorts, in which more than twice as much coal is treated in the same area as in a house containing an equal number of horizontal retorts. Mr. Beal accordingly suggested a design for the retort-house which had been adopted for the one to be erected; and he believed it would be found by experience to be admirably adapted for the manufacture of coal gas, and also economical in construction. He submitted two views of the proposed building, in which it is expected to make, when all the settings are in use, upwards of $2\frac{1}{2}$ million cubic feet of gas per day, or 110,000 cubic feet per day per man engaged in handling coal and coke; using in the generators from 11 lbs. to 14 lbs. of coke per 100 lbs. of coal carbonized. These works being on the water front, arrangements will be made to take most of the coal

directly from the boats into the bins over the retorts; the coal-shed being used for the storage of emergency coal only. In connection with this plant, which will in a few years send out from 8 to 10 million cubic feet of gas per day, machinery for the expeditious and economical handling of coal and coke will be installed, as will also the most improved appliances for condensing, purifying, &c. In reference to this subject, the President remarked that there had been a strange conservatism and lack of interest in America with regard to inclined retorts. While it was true that they were experimented with in St. Louis twenty or more years ago, they were only adopted in a practical way at Louisville (Ky.), and at the works of the King's County Gas and Illuminating Company, in Greater New York, in the latter part of 1899. In England, however, benches of inclined retorts were in use more than a decade before this; and there were now more than 10,000 of these retorts in use in the British Isles. In Germany and Austria, too, they had been generally adopted for many years. Mr. Beal closed his remarks on this matter by recognizing the difference of opinion as to the value of this system existing in America, and by expressing his pleasure that the paper on the subject given last week (p. 1209), in which a member stated his objections thereto, had been prepared for the meeting.

The next subject dealt with was the extension of the use of gas, on which the President spoke as follows: The invention and development of the Welsbach burner put us in a position to hold our own in most branches of commercial and domestic lighting, and to push our business into the almost unlimited field—hitherto neglected, because unappreciated—of the patronage of persons of small income. For this business, and for that equally important and only partially developed one sure to come to us in the use of gas for power and cooking, coal gas, with its heat units and low manufacturing cost, is, we believe, to take on its old-time position, and to again lead, in point of volume, its now known-to-be-friend and ofttime associate, water gas. In this connection, the disastrous strike of the anthracite miners has demonstrated the almost necessity of including both coal and water gas apparatus in all plants of medium and large size. In fact, it is difficult to overstate the value of such practice as a provision against emergencies, as a means for controlling the market for coke, and as a source for obtaining gas-making material in such a crisis. Provincial as to environment, and seemingly protected by it, lulled into a sense of security by the acceptance of a generous appropriation of the unearned increment which has come to all who have been intimately associated with undertakings connected with the land in our growing cities or with industrial pursuits, we have been short in enterprise, long in conservation, and out of touch with that necessity which always has been, is, and ever will be the mother of invention. In the coke-oven process, with its tremendous advantage of association with other enterprises, which has amply proved its fitness to live where wisely constructed, capitalized, and operated, both abroad and in America, and in the system of inclined retorts, proved to be a decided advance by scores of our less conservative brethren in England and on the Continent of Europe during many past years, we have the suggestion, the experience, and the opportunity, wherever we may be confronted with the necessity for extension, as is the case with most of us, of arranging for a permanent prosperity.

Of course, the President did not fail to recognize that there were some among his auditory who were associated with communities thought to be too small to warrant the adoption of the systems he had referred to, notwithstanding the fact that inclined retorts might be used to great advantage in small works. In such places, all the public utility properties not owned by the municipality should, he urged, be under a single management. Under one head such properties would have the suitably rewarded services of men who, if new to the situation, would, if deserving, adapt themselves to the new environment, and their best efforts would be given to secure better management at less cost, better services at lower charges, and better results generally. The ownership or control of many companies by a single organization—affording opportunity for a comparison of results, for classifying details, for experience in the selection and use of men and machinery, and of improved business methods, for the broadening effect upon local managers of the pressure to keep up with development in all lines, and to make advance in matters hitherto neglected—had, he said, done more to stimulate workers in the gas business, and to put their properties upon a safe basis, than all other influences combined. He added that this subject, which necessarily, in spite of their prejudices, had two sides to it, was gaining the attention of the public, and winning advocates throughout the country.

Reference to the grouping of companies under one management naturally led to some observations on the subject of the municipalization of public undertakings. The President remarked that in a state of society approaching the ideal, municipal ownership, with control of all public service utilities, such as gas, electricity, &c., was logical and desirable. In the present state of society, however, it had not been demonstrated a success as far as was known, probably for the reason that the best management, which was always the expression of brains and ability, had not found sufficient reward in Government service, and also because of the undesirable influence of incompetent official supervision and association. Privately owned companies, where ability and enterprise were rewarded by added compensation to managers and just profits to owners, and where the merit system was found at its best, would doubtless hold their own for a long time to come against any demand for public ownership; but the best safeguard which they had against the seeming trend of public opinion was, he thought, their own conduct towards the communities they serve, which should result from the careful study of the interests of the public from the attitude of good citizenship. It should be their effort, he said, to secure the co-operation of the municipalities they served, instead of allowing them to assume a defensive attitude, as was too often the case. This was a subject interesting alike to the engineer and the manager—suggesting to the one the importance of low cost production, and to the other a mutuality of interest in all business relations with consumers. He favoured the appointment of a Committee of five—one from each section of the country—so as to secure, by requests from members of the Association, information as to laws proposed or passed, and as to the character and result of discussion, if any, in cities, &c., in relation to the question of municipalization. In connection with this subject, Mr. Beal mentioned that at the date of the last census there were in the United States 23 gas plants and 273 electricity plants operated by municipalities.

After a brief reference to the taxation of gas undertakings, on which subject a paper was to be submitted to the members, the President alluded to the desire of some managers of the more conservative school to see State Gas Commissions established, to safeguard gas properly from senseless competition and reckless exploitation. In order to have their earning capacity assured, protection must, he said, be afforded against attack by speculative interests, evil legislation, and municipal assaults by corrupt politicians; and, in his opinion, this could never be secured except by a State law. He expressed the belief that the best interests of all companies supplying limited populations would be served by the creation of these Commissions. The wasteful competition to which suppliers of gas had been subjected, owing to the installation of electric light plants, had been wisely met, and in many instances disposed of, by the acquisition of such plants, and the conduct of the light, heat, and power business under a single management. He thought he might safely say that the managers of such united plants had had the stimulus of the wonderful development which had taken place in machinery and apparatus for generating the electric current, and adapting it to the various uses to which it is now put.

Passing on to deal with the educational scheme of the Association, the President remarked that if it had no other work, this alone would commend it to all thoughtful men who have outgrown the influence of the provincialism that unfortunately goes with a business which, by its nature, is confined to a neighbourhood. He urged the most strenuous efforts on behalf of the educational fund, and appealed for generous subscriptions to it, so that the work might not only be kept up, but extended to those who are now excluded. He laid stress upon the importance of giving every advantage to men who have the sturdiness of character to determine to acquire knowledge while following their daily pursuits. In this connection, he cited the work of the City and Guilds of London Institute, some account of which in the past session was published in the "JOURNAL" last week.

In view of the prominence lately given to the subject of electrolysis, it could not be passed over; and it was accordingly alluded to by the President towards the close of his address. He remarked that of all the problems that have arisen to add interest to the gas manager's life, there is probably none which he has taken up with a greater sense of impotency than that of the electrolytic corrosion of his mains and services. In America, there is not, as here, a Board of Trade, having power to draw up a model clause for incorporation in all franchises conferring the right to lay trolley lines. The granting of franchises is almost entirely in the hands of the local authorities of each community, who have the right to impose such conditions as they see fit. In many cases, owing to the desire to secure increased transportation facilities, rights are granted which do not adequately provide for the protection of other interests. It seemed to the President that a subject of such great interest to the whole industry should receive some formal recognition from the Association; and he said he should like to see a Committee appointed which would make a careful investigation of the whole problem, and submit a report in such form that it could be used by managers in framing arguments for presentation before their local authorities.

The last subject dealt with was the future of the gas business. In estimating its possibilities, the President said it might be assumed that it would hold the field permanently—that while the suppliers of gas might lose some of the patronage of the well-to-do, owing to the adoption by them of electric lighting, the much broader and better domain of the multitude was open to, and ready for occupancy by, the older illuminant. There were good reasons for believing that the make of gas from bituminous coal only would increase rapidly, as the apparently inexhaustible deposits of such coal, and the existing facilities for its transportation, would ensure the continued supply and low price of this material. Inclined retorts, of practicable lengths as required, with full-depth regenerative furnaces, were adapted to most gas-works. Put up as suggested, they represented pretty nearly ideal conditions as to labour costs and control, with marked economy in fuel. They were the only demonstrated improvement in apparatus for carbonizing coal since the beginning of the business. "We represent," said the President, in drawing his address to a close, "one of the greatest and most widespread industries of the

country, and of the times in which we live. With the large number of technically trained men who have come among us with young and vigorous minds untrammelled by tradition, and with our efficient practical engineers and managers, we may confidently look forward for the exercise of that genius, enterprise, and thoroughness in the development of our business that is so characteristic of our countrymen. In closing, I plead for a continuance of, and a growth in, that broadness of spirit that has characterized our Association's work; for a continuance of, and a growth in, that spirit of enterprise which has come to most of us as the result of enforced competition with other forms of lighting; and for the putting behind us of all mystery, or half mystery, as to methods or results."

COMPETITION OF ELECTRICITY WITH GAS IN GERMANY.

The following is an epitome of a paper on the "Working Results of Electricity Works and the Prime Cost of Producing Current," which was read by Herr F. Ross, of Vienna, at the Meeting of the German Association of Gas and Water Engineers at Düsseldorf in June last. The paper was published in a recent number of the "Journal für Gasbeleuchtung." Some of the author's conclusions are canvassed in our "Essays" columns this week.

The author, at the meeting of the Association in 1891, expressed the opinion that the local authority of each town should undertake the supply of electric current in the same way as gas and water. His opinion then met with almost universal opposition. Another view which he expressed to the effect that the cost of production of electric current on a large scale would not differ much from that of illuminating gas, was also questioned. But in the ten intervening years, electricity works have advanced from small to great; and it now appears to be opportune to discuss the situation of these works in regard to production, in order to see whether what was formerly stated as to the expense of producing current, has really been substantiated. The author's profession, of consulting engineer on the construction and working of electricity works, has given him the opportunity of becoming acquainted in detail with the conditions concerned, from a more impartial standpoint than is perhaps possible to the managers of individual works.

It has often been said that the development of electricity works has not exercised any considerable influence on the development of gas-works, which are generally their competitors. It appears advisable to see whether this is actually the case, and whether the influence will not be more strongly felt in the next few years. To arrive at a just conclusion on this point, it will not do to make comparisons of the works of any particular town; the inquiry must extend to a large series of works, to have any value. With this object, the statistics of the gas-works of twenty large towns* have been taken, all being places where electricity works have existed some time; and the working results of these undertakings for 1891 have been compared with the figures for 1900.

The population of the twenty towns was about 5,700,000 in 1891, and about 7,280,000 in 1900. The total quantity of gas sold was 11,545 million cubic feet in 1891, and 17,598 millions in 1900. For cooking, heating, and business purposes, the quantity sold was 1110 million cubic feet in 1891, and 5945 millions in 1900. These figures show that, with an increase in population of 27·7 per cent., there is an increase of 52·4 per cent. in the gas sold. The gas consumption per head of the population has increased by 19·5 per cent. during the ten years. But whereas ten years ago, 90·4 per cent. of the gas sold was for lighting purposes, the proportion had gone down to 66·2 per cent. in the last year. This indicates that the greater part of the increase in consumption has been for heating and business purposes. That such is the case will appear more clearly on regarding the consumption per head for lighting purposes. In 1891, it amounted to 1828 cubic feet, and in 1900 to 1599 cubic feet; having thus gone back 12·6 per cent. This decrease is the more striking, as the total consumption of gas per head has risen by 19·5 per cent. In this period, the Welsbach light was being generally introduced; while it was also a time of great industrial development, and of largely increased demands for light. There can, therefore, be no doubt that this decrease in the amount of gas consumed for lighting purposes clearly reflects the effect of the competition of electric lighting.

The effect on gas sold for motor purposes may be taken next. As all gas-works do not publish separately the amount of gas consumed for motor purposes, a full comparison in respect of quantity is not feasible. But the number of horse power installed will give fairly trustworthy data. In 1891, the towns in question had gas-motors of a total capacity of 16,273-horse power; while in the year 1900, the total horse power had risen to 34,422—an increase of 18,149-horse power. On comparing this with the figures of the electricity works, it will be found that in the same towns 50,687-horse power electric motors, exclusive of tramway motors were installed in 1900. As there was scarcely one electric motor ten years ago, the increase of 50,000-horse power has to be compared with the increase in gas-motors of 18,000-horse power. It must also be remembered that the electricity works have a much smaller area of supply than the gas-works.

The figures given show that where electricity is to be had at a moderate price, the competition of the gas-motor will not be of any account. The statistics also show that the ratio between the current sold for lighting and that sold for other purposes is still more unfavourable for the electricity works than is the similar ratio for gas-works. Of the total current sold, 24·5 per cent. was for lighting, 22·1 per cent. for motors, and 53·4 per cent. for tramways. The difference in the selling value of a unit for lighting purposes and for other uses is much greater for the electricity than for the gas-works. While the gas-works sell about two-thirds of their production for lighting purposes, the electricity works give over two-thirds of their production to the less profitable customers. To be able to work with advantage under such conditions, the electricity works have been obliged to keep down their working expenses as much as possible. The chief item is the sum for interest on and for writing off capital. The cost of installation per kilowatt maximum hourly capacity amounted to between £75 and £150. Apart from the interest on the capital invested, the amount for renewals must be taken into account. Experience has shown that, with a rationally constructed works, 8·5 per cent. on the invested capital will suffice for interest, amortization, and renewals. The interest charges decrease rapidly as the number of burning hours per annum increases. ("Burning-hours" is the total quantity sold per year, divided by the maximum hourly output.)

The gas-works figures show that for 2000 burning hours (actually 1916 in 1900) the amount for interest, &c., fluctuates between ¾d. and 1½d., and for 1500 hours (actually 1534 in 1891) between 1d. and 2d. Some electricity works have, however, succeeded in securing a much greater number of burning hours; while works which supply almost exclusively for lighting purposes reach over 1500 burning hours. It must also be noted that the expenses of extending electricity works will come much lower than the average value of the present capital; so that in future smaller amounts may be reckoned for interest, For the electricity works, the total working expenses, including management and maintenance, amounted to between 0·78 and 2·4d. per kilowatt-hour. The first figure is not to be taken as the extreme lowest limit of the cost of producing current, as at the works which show this figure, the amount for fuel is 50 to 60 per cent. of the working expenses, and considerable economy is possible here. In the future, the working expenses of large electricity works will certainly come down to 0·72d. to 0·96d. per kilowatt-hour, and the total expenses to 1½d. to 2¾d., according to the capital sunk.

As most gas-works have been built by degrees, it is difficult to ascertain the figures for the original capital outlay. The author has only been able to obtain those for Düsseldorf £420,000, for Cologne £750,000, and for Vienna £2,700,000, in round figures. Allowing 8·5 per cent. interest on capital, the amount per 1000 cubic feet of gas sold is nearly 1s. 3d. for Düsseldorf, 1s. 4½d. for Cologne, and 1s. 10d. for Vienna. Adding to these values the cost of producing the gas—viz., 1s. 3½d. to 1s. 5d., the prime cost of the gas is obtained. This does not differ per cubic metre (35·3 cubic feet) much from that given above for current per kilowatt-hour in large electricity works. It must not, however, be forgotten that the market value of a kilowatt-hour, both for lighting and motor purposes (except for tramway current), is at least twice as high as that of a cubic metre of gas.

It may therefore be anticipated that in future electricity works, especially those in private hands, will reduce their price per kilowatt-hour for lighting purposes to 3·6d. to 4·8d. in the next few years, in order to compete with gas. Such a reduction in price will undoubtedly cause the sale of gas for lighting purposes to decrease considerably, even if the hopes of electricians—that lamps with a smaller consumption of current will be produced—are not fulfilled at all or are only realized to a small extent.

*The towns are Berlin, Hamburg, Cologne, Copenhagen, Dresden, Leipsic, Munich, Breslau, Stockholm, Düsseldorf, Bremen, Magdeburg, Chemnitz, Elberfeld, Nuremberg, Barmen, Strassburg, Stettin, Königsberg, and Cassel.

Professor Lewes's New Course of Cantor Lectures.—As already announced, Professor Vivian B. Lewes, F.I.C., F.C.S., will deliver a course of Cantor Lectures at the Society of Arts, on the 24th inst. and three following Monday evenings, on "The Future of Coal Gas and Allied Illuminants." In the opening lecture, he will review the effect of the past twenty years on the manufacture of coal gas, and discuss the question of high *versus* low illuminating power. The methods available for the economic production of low-grade gas will be mentioned, and the effect of temperature on carbonization considered. In the second lecture, Professor Lewes will deal with the dilution of coal gas by gases cheaply produced, and discuss the effect on the calorific value of gas of lowering the candle power. This will lead to some remarks on the photometry of low-grade gas, and on the conditions under which its illuminating property is best developed. These questions will be further considered in the third lecture, which will close with some observations on the probable future of coal gas. The concluding lecture will open with a review of the advances made in lighting by oil during the past fifty years, and the lecturer will show how this material can be utilized with incandescent mantles. The rest will be devoted to vapour burners, air gas and acetylene. The lectures will begin at eight o'clock.

CONVERSION OF COAL GRATES TO GAS-FIRES.

In an article which appeared in the "JOURNAL" recently, it was pointed out that the makers of gas-fires have of late been turning their attention to a requirement of gas consumers by providing means of converting, in a cheap and simple manner, ordinary coal-fire grates into gas-fires. No one thinks now of effecting the conversion by adapting a burner to the bottom fire-bars of the ordinary grate, and piling up ball fuel on the top.

That was a makeshift sort of system, which, as such crude expedients often are, was wasteful in the extreme and annoyingly ineffective in results. Messrs. Wilsons and Mathiesons call attention to a neat and pleasing fire which they have devised for this purpose of transforming an ordinary grate into a gas-fire. The change is simply accomplished by removing the old fire-bars, and so immediately providing the necessary accommodation for the gas-fire—the fitting being an easy matter. The type illustrated (which as will be seen is complete in itself) is made in a good range of sizes—to fit any grate with a 12-inch to 18-inch opening. These fires are said to be remarkably good heaters; and great care is exercised in their construction to ensure that there is perfect combustion of the gas used in them. The "Register" should be very popular among consumers who do not require an expensive fire.

REGISTER OF PATENTS.

Gas-Meters.—Thorp, T., of Whitefield, Lancs. No. 20,214; Oct. 10, 1901.

This invention relates to meters for measuring the flow and volume of gases, constructed on the turbine principle—generally known as inferential meters. The arrangement was specifically referred to by Mr. T. G. Marsh in the paper he read before the Gas Institute last June.

The present chief defect of meters constructed on this principle (says the patentee) is that accuracy of measurement can only be relied upon above a certain rate of flow through the meter, below which there is either no motion of the parts due to their inertia, or the motion does not correspond with the rate of flow; and consequently such meters are only suitable where the conditions are favourable to their use, as when the flow is constant above a certain velocity, and when accurate measurement is not a desideratum.

In fig. 1, the whole of the gas to be measured passes through a cylindrical chamber A, entering through a lightly loaded non-return valve B. The chamber is provided at the top with a turbine wheel C, the vanes of which, set at a suitable angle to the vertical (preferably at an angle of 45°) are made as light as possible—for instance, of thin aluminum sheet. Beneath the centre of the wheel is a baffle-plate or shield D, the solid central part of which supports a spindle, which rests upon a hardened steel or iridium centre point entering a countersunk step in the end of the spindle, which is jewelled for the purpose of reducing the friction to a minimum. Between the central solid part of the baffle-plate and the wall of the chamber A is an annular margin, which contains perforations or slots forming small passages E, which direct the gas in parallel streams upon the turbine vanes. Above the wheel C, and connected to the main chamber by screws, is a plate F carrying an index G actuated from the spindle of the wheel.

In the case of large meters, and where a back flow of the gas is to be apprehended, a liner is fixed inside the chamber A, forming an annular chamber H round the valve B at the bottom and round the periphery of the chamber, which extends near to the underside of the passage E. The width of the space between the bottom and flange is adjustable, by means of sets of screws.

The apparatus thus constructed is placed into a casing having a gas inlet and outlet, and so arranged that the gas must pass from the inlet to the outlet through the chamber A. Preferably the casing is made in the manner shown, with the inlet and outlet branches opposite each other, and a cylinder in the centre with a partition plate surrounding same and dividing the inlet from the outlet, so that the gas has to pass through the cylinder from one to the other.

The action of the apparatus is as follows: When the gas pressure on the inlet side exceeds that on the outlet side, the valve B is opened. As the valve lifts, gas first passes into the annular chamber H, and through the hole and the guide-channel E above, and impinges upon one of the vanes of the fan C. This small current of gas causes the wheel to revolve, so that its vanes are acted on more energetically by the current, which (although small) flows under pressure, than if the same small current were distributed over the whole area of the guide-vanes. When, however, the current is larger, the valve B is lifted farther, and the gas enters the chamber A, and passes in parallel streams through the passages E and rotates the wheel. To prevent the gas eddying and from ascending only along the wall of the chamber and acting only on the outer part of the turbine vanes, preferably a baffle-plate I or its equivalent is arranged, which distributes the current evenly over the whole area of the guide channels and vanes. By means of these arrangements, even very small currents of gas are said to be indicated with accuracy; and no return flow of gas, rendering the indications incorrect, can take place.

Where, however, the quantity of gas passing through the meter is comparatively small, and no return flow of the gas is to be apprehended, the inner liner forming an annular chamber with fine outlets may be omitted, and holes drilled through from the outside of the valve-chamber, so as to direct the small jets of gas passing through them upon the outer parts of the turbine wheel. A meter suitable for small quantities is represented by fig. 2. The inlet in this apparatus is at

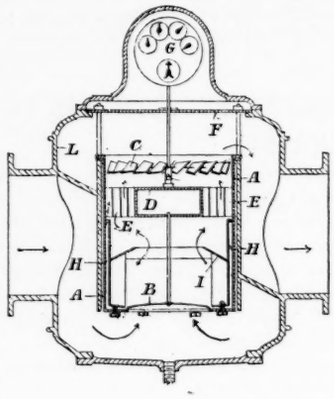


Fig. 1.

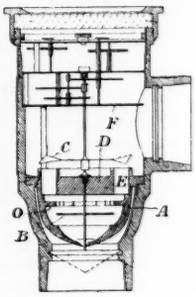
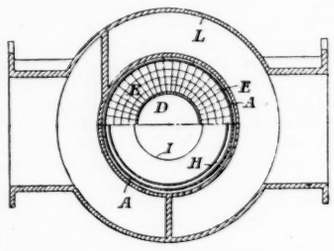
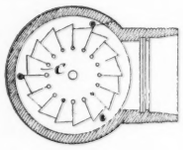


Fig. 2.





the bottom, and the outlet lateral; the gas passing through the chamber A. The latter is fitted with a valve B at the bottom, the stem of which is guided between the ends of four prongs. The baffle-plate D is surrounded by passages E, below which one or two rows of baffles O, preferably formed of triangular plates, are arranged, to prevent the flow of the gas taking place chiefly at the circumference of the chamber A, and to distribute it evenly through the passages and over the vanes C of the wheel. A small hole is drilled through the flange of the main chamber, and directs a small jet upon the outer part of the wheel when the gas-outlet is opened.

Incandescent Filaments and Mantles.—Boult, A. J.; a communication from A. M. Plaissetty, of Paris. No. 20,747; Oct. 16, 1901.

Before referring to the patentee's account of his invention, attention may be directed to the article on the same subject that appeared in the issue of the "JOURNAL" for the 28th ult., p. 1133.

M. Plaissetty points out in his specification that incandescent mantles in use at present suffer very seriously from the following defects: 1. Great fragility. 2. A tendency to shrink after prolonged use. 3. A progressive loss of light-emitting power. These defects are said to have been remedied to a considerable extent by using a mantle which before burning is composed of cellulose in the condition of artificial silk (called "lustra-cellulose") and hydrated oxides of the illuminating metals; the inorganic matter bearing a much larger proportion to the organic than has been hitherto possible. A mantle so composed is non-hygroscopic, and may be kept unburnt for a long period; and, after burning, a mantle is produced in which the above-mentioned defects are greatly diminished.

In view of the article already referred to, it is not necessary to give more of the patent specification; but some of the principal claims may be mentioned: 1. In the manufacture of mantles for incandescent gas lighting, the use of a fibre of non-nitrous lustra-cellulose in which are incorporated the hydrated oxides of the illuminating metals. 2. The use of hydrated oxides of illuminating metals in conjunction with a non-nitrous solution of cellulose. 3. Incorporating the hydrated oxides of the illuminating metals with a non-nitrous solution of cellulose, forming the mixture into fibres, and ultimately into mantles. 4. When using a non-nitrous solution of cellulose incorporating therein, either before or after the fibres are formed, illuminating substances in the form of hydrated oxides. 5. Incorporating the hydrated oxides of the illuminating metals with a cuprammonium solution of cellulose. 6. A mantle for incandescent gas lighting consisting of cellulose which has been dissolved by means of copper ammonium solution which has been then incorporated with the hydrated oxides of the illuminating metals, and subsequently formed into fibres, coagulated, washed, dried, woven, or knitted. 7. The process of manufacturing mantles for incandescent gas lighting which consists in soaking a non-nitrous lustra-cellulose in a solution of illuminating salts, drying and transforming the salts to hydrated oxides by ammonia or the like, and completing the mantle. 8. In lustra-cellulose mantles impregnated with a solution of the illuminating metals and dried, transforming the metallic salts to oxides by ammonia or other suitable alkali before burning. 9. An unburnt mantle for incandescent gas lighting composed of hydrated

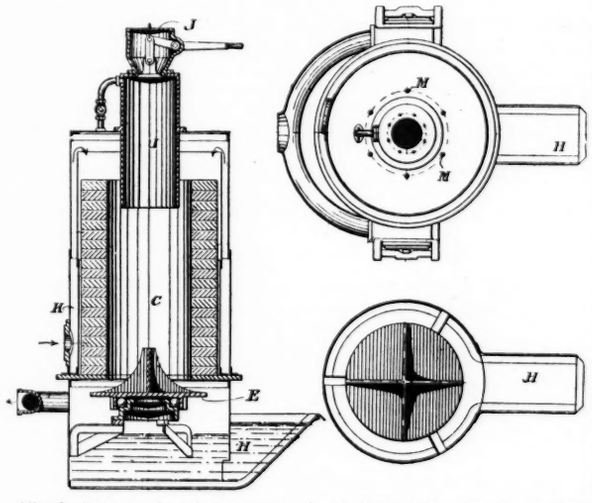
oxides of the illuminants and non-nitrous lustra-cellulose in which the proportion of oxides to lustra-cellulose has been increased above that heretofore possible—namely, to 30 per cent. of anhydrous oxide. 10. A mantle for incandescent gas lighting which at the moment before burning is composed of non-nitrous lustra-cellulose and hydrated oxides of the illuminating metals in such proportions that the weight of the mantle after burning is from 30 to 42 per cent. of the weight immediately before burning.

Gas-Producers.—Crossley, W. J., of Manchester, and Atkinson, J., of Marple. No. 22,016; Nov. 1, 1901.

This invention relates to the construction and operation of a producer suitable for making gas of low calorific value for driving gas-engines and for heating purposes generally, "having in view more suitable arrangements for using bituminous coal or other fuels containing tarry or volatile matters, which are converted in their passage through the producer, more or less completely, into permanent combustible gases." An essential feature of the producer is that the fuel is introduced at the top, and is continuously consumed downwards; the air for supporting combustion being introduced at the top, and the gases taken away from the bottom.

The illustrations show a vertical section of the producer, a plan, and a horizontal section through the lower portion.

The producer is constructed with a vertical cylindrical body lined with fire-brick or other refractory material throughout the portion C, which contains the fuel under combustion; the fire-brick being contained in an iron shell. At the bottom, the fire-brick lining is supported on a substantial flat iron ring. Under this ring is a solid, circular, horizontal, revolving grate E, having ribs on its upper side projecting into the fuel bed; a space being left between the ring and the grate for the passage of the gases and the ashes, which fall out as the grate is revolved. The lower portion of the producer is a water lute which assists in keeping the grate and the ring from being overheated, allowing the removal of the ashes by means of an opening H, which is accessible to the outside without interfering with the continuous working.



The fuel is introduced by means of a bell I and hopper J attached to the middle of the top plate, so as to regulate the depth of active fuel and to keep a reserve. The air (with or without water vapour) is introduced at the lower part of an annular space K contained between the producer shell and an outer shell, so as to pick up heat as it rises to the top of this space. "By this and other means, the air may be heated to a considerable extent, so as to keep the hottest zone of combustion high up in the producer and away from the grate."

The bell defines the active depth of the fuel; and the distance from its lower edge to the grate level requires to be suitable for the fuel used and for the size of the producer. The larger the producer and the larger the fuel, the greater this distance should be. It may be filled with fuel so as to hold a reserve, and as the fuel burns away, it drops out of the bell into the producer itself. As there is no material supply of air to the fuel in the bell, it cannot burn in the bell, but can only commence to burn after passing out of the lower end.

In the top plate there are a number of holes M closed normally with taper plugs, which may be removed for the purpose of allowing for the passage of a poker, which may be thus passed down through the body of fuel, so as to keep it in a suitable condition should such poking be necessary.

Testing the Quality of Gases Used in Engines.—Edmondson, J., of Bradford. No. 22,595; Nov. 9, 1901.

This apparatus is designed for testing the quality of gases used as fuel in internal combustion engines and for ascertaining the explosive value of the gas.

As the patentee points out, in engines in which the fuel is producer, Dowson, Mond, or blast-furnace gas, the variations in the quality of the gas are so great as to require frequent re-adjustment of the proportions of gas and air admitted to the cylinder; and an instrument for testing the quality of the gas so as to indicate the most advantageous position of the valves governing the supply of gas and air is a desideratum. The apparatus he suggests consists of a bunsen burner with an adjustable air-valve having a graduated scale indicating the amount of opening given to the valve. The orifice for gas and the surrounding tube are made of such dimensions that when the air-valve is closed, the flame remains at the top of the tube; but when air is admitted so as to produce a sufficiently explosive mixture, the flame immediately descends through the tube to the gas-orifice, and there continues to burn. The figures on the scale indicating the extent of the opening of the air-valve show the explosive value of the volume of gas entering the burner. The instrument is, by preference, so proportioned that, after the flame has descended to the gas-orifice, or to a perforated disc above it, if the air supply be cut off, the flame will again rise and continue to burn at the top of the tube.

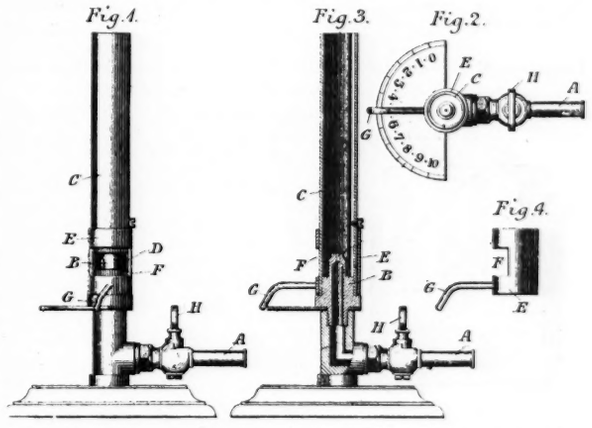


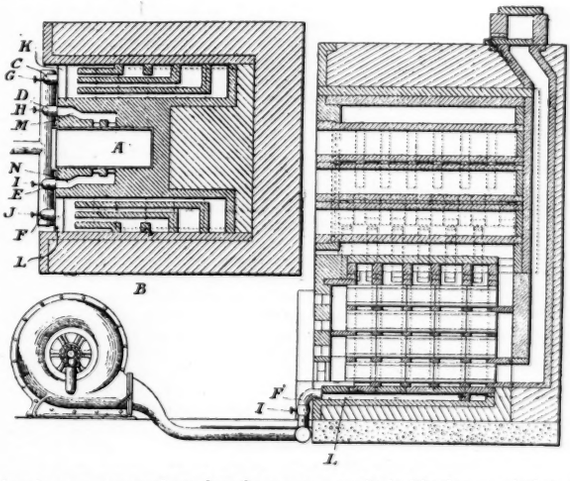
Fig. 1 is an elevation, fig. 2 a plan, and fig. 3 a sectional elevation of the apparatus. Fig. 4 is an elevation of a shutter for closing the orifice which admits the air.

The pipe A connects the gas supply to the burner B. Surrounding the burner is a tube C with an orifice D for admitting air. The tubular shutter E fits as a sleeve on the tube. It has an orifice F, which, in the position shown in fig. 1, leaves the orifice D in the tube C wide open; but when in the position shown in figs. 2 and 3, it proportionally diminishes it, and when moved to the position in which its index G points to the zero of the scale closes it altogether.

To use the apparatus, the cock H is fully opened, the shutter E is placed with its index at zero, and the gas is lighted at the top of the tube C. As the index is moved along the scale, the shutter, travelling with it, proportionately opens the orifice D in the tube C. The increasing volume of air so admitted gradually alters the character of the flame, which, as the index is moved up the scale, becomes more and more unstable, and finally drops to the orifice of the burner. The point on the scale at which this takes place indicates the explosive quality of the gas—the more air the better the quality.

Regenerative and other Furnaces and Kilns.—Drake, J. A., of Ovenden, Halifax. No. 22,891; Nov. 13, 1901.

This invention is stated by the patentee to be particularly applicable to generator and regenerator or recuperative furnaces in which there is incomplete combustion of fuel in a gas-producer or the like, with production of combustible gas, which is burnt in a combustion chamber. Under the present system of chimney draught, he says that to overcome the friction caused by the passage of the air through the recuperator chambers, the pull or vacuum operates directly upon the producer, the effect of which is to burn an unnecessarily large quantity of fuel, while clinker is formed to excess. But by his invention forced draught is applied to both the primary and secondary air flues, and



also, in some cases where found necessary or desirable, he uses induced draught in addition. The power may be obtained by steam injection or other mechanical means necessary to ensure a regular supply of secondary air for the purpose of effecting complete combustion in the combustion chamber, furnace, oven, or kiln, as the case may be, and thus relieve the combustion chamber and producer of the strong draught which has previously been found necessary; means being provided whereby the forced draught may be applied to the producer for the evolution of combustible furnace gases if found desirable.

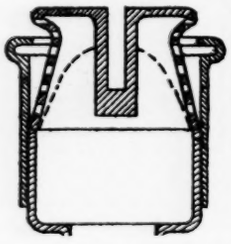
A represents the gas-producer or primary combustion chamber; B the blower; C, D, E, F, the air pipes from the blower, which are

connected with the air inlets; and G, H, I, J, the valves controlling the air supply.

By opening valves G and J, and closing valves H and I, the forced draught can be applied to the secondary air inlets K L; while the primary air inlets M N are supplied with free atmospheric air through sliding shutters. By opening valves H and I, and closing valves G and H, the forced draught may be applied to the primary inlets M N; while the secondary air inlets receive air freely from the atmosphere through the opening of the slides.

Incandescent Gas-Burner.—Blake, R. A.; a communication from J. Hardt, of Hamburg. No. 24,986; Dec. 7, 1901.

This invention relates to a burner for use with an incandescent mantle, whereby finely divided streams or jets of an intimate mixture of gas and air are caused to issue radially in horizontal directions from the periphery of the burner head and produce a flame of ball or bulb shaped form as to be, in contradistinction to the form of the flames of incandescent gas-burners of the usual construction, "of a greater diameter and in contact with a larger portion of the surface of the incandescent mantle—thereby effecting the greatest possible amount of illumination."



The upper end of the mixing-chamber (as shown) is constituted by a solid circular plate or disc supported by a perforated conical socket, so as to form an inverted cup having a flaring or tapering wall. The cup is so arranged that a lateral annular outlet passage for the gas and air mixture is formed. Just below the disc, the perforated, outwardly tapering wall is provided with a strongly marked contracture or shoulder; and it is this shoulder, in combination with the laterally projecting edge of the disc already referred to, which, in consequence of their peculiar influence upon the issuing gas and air mixture, form the most essential features of the invention.

Gas-Burners.—Stefan, W., and Schönfelder, H., of Brieg, Germany. No. 15,731; July 15, 1902.

This invention relates to a gas-burner wherein a special woven fabric is interposed for the gas to pass through on its way to the burner-orifices. The weft wires of the fabric are close to one another, while the thicker wires of the warp are arranged a certain distance apart. The meshes produced, therefore, instead of being perpendicular to the surface of the fabric as is usual, are inclined to the surface. The resistance which the gas meets with on its way through the fabric is much increased, it is claimed, as it is obliged to alter the direction of its motion and choose a zig-zig path; whereas when the ordinary fabric is employed, the gas flows in an unaltered direction through the meshes, and the resistance met is that of the wires alone. With the usual fabrics then, the patentees assert, there must be a steady, if diminished, passage of gas to the flame; whereas with the increased resistance offered by the fabric employed under their invention, gas will only be drawn through by the flame as fresh gas is required to feed it, and the consumption is accordingly considerably lessened.

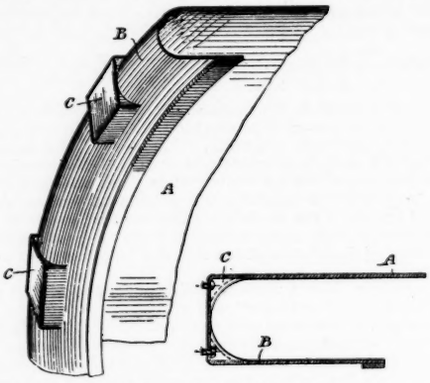
Mantles for Incandescent Lighting.—Bousfield, J. E., a communication from R. Finke, of Nuremburg, Germany. No. 17,603; Aug. 11, 1902.

Explaining his invention, the patentee says: During the last few years, a considerable amount of evidence has accumulated, that the substance known as cerium is not a chemical element, but consists of a mixture of at least two, if not more, elementary substances. Various preparations of ceria, free from lanthana, didymia, and other rare earths, when used with thoria, in the proportion of 2 per cent. of the former and 98 per cent. of the latter, give mantles of widely differing illuminating power and differing stability. It is found that when a solution of so-called pure cerium nitrate in water is precipitated with dimethyl-aniline, a portion of the ceria remains in solution. This portion, when transformed in the usual manner into the nitrate, gives, when mixed with the usual proportion of thoria-nitrate, a mantle of very low illuminating power, while the portion that has been precipitated with dimethyl-aniline, when mixed with thoria nitrate as before, yields a mantle of very high illuminating power and great durability. According to this invention, a solution of thoria nitrate as pure as possible is prepared as follows: Commercial thoria nitrate is fractionally precipitated with potassium chromate, and then the intermediate fractions between the first two and the last, which are rejected, are converted into the nitrates—great care being taken to remove all chromium. The nitrate thus obtained is mixed with nitrate obtained from the dimethyl-aniline precipitates, so that 98 parts of thoria and 2 parts of the cerium fraction result when the nitrates are ignited. Finally, a fabric made of ramie fibre is impregnated with a solution containing 9 per cent. of the mixed earths and converted into mantles in the ordinary manner.

Dips of Telescopic Gasholders.—Carpenter, C. C., of Old Kent Road. No. 18,752; Aug. 26, 1902.

The patentee proposes the use in telescopic gasholders of rounded dips having flat bosses or projections pressed out of them as shown. He remarks that telescopic gasholders are now usually constructed with Piggott's cups and dips—that is to say, the bends of the cup of the inner shell and of the dip of the adjoining one are rounded instead of square in section, which produces a much stronger construction and allows of the required shape being pressed instead of being built up. The attachment and adjustment of the guide carriages or brackets thereto has, however, proved somewhat difficult; and it is the object of this invention to overcome this difficulty by forming flat portions on the curved surface of the dips where the carriages or their attachment are required.

A perspective view is given of a portion of a dip with the invention applied to it; also a cross section taken through the flat portion. A is the lift of the holder, and B the dip—rounded in cross section. When

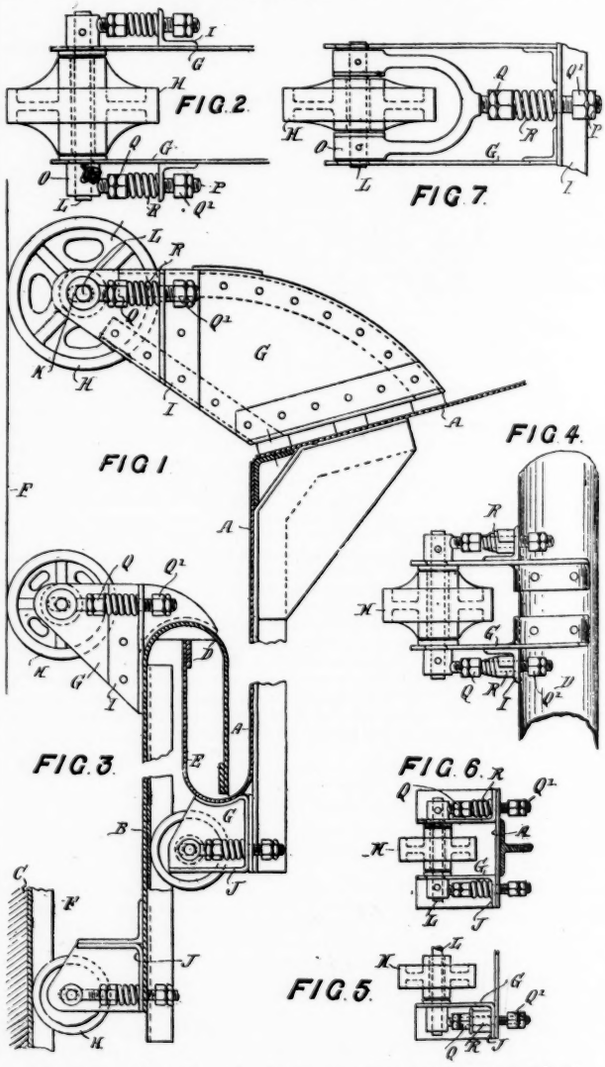


forming the dip, flat rectangular bosses C are pressed out in any convenient manner as and where required. To these portions the guide carriages or brackets (not shown) are secured by bolts and nuts, or in any other convenient manner.

It will be obvious, the inventor points out, that the attachment to these bosses C can be made much more securely, and at the same time with greater facility for adjustment horizontally, than would be the case in a semi-circular or rounded dip.

Guiding Wheels or Rollers of Gasholders.—Carpenter, C. C., of Old Kent Road, S.E. No. 18,921; Aug. 28, 1902.

In the guiding of gasholders (the patentee remarks) in the framework erected for the purpose or in the tanks, guiding contact as between the holder and its framing or the guides within the tank in which it works



usually takes place through wheels or rollers suitably mounted on carriages or brackets affixed to the sides or roof of the holder—such

wheels working within or against the guide-paths provided for the purpose. If the tank guides were always vertical, or if the framing were always vertical, or if the gasholder and its framing could be maintained at an equal temperature throughout the year, and expansion thereof, and the consequent increase or decrease in the diameters of the guiding or guided portions of the structure did not take place, this invention might not be necessary. But it is found in practice that, in many cases, these guides are not vertical, or the guide-framing is not vertical either wholly or in part. In such instances, it will be obvious that if the guide wheels or rollers are so rigidly mounted as to remain always in contact, they must be subjected to undue strains at certain portions of their travel. It is also found that the expansion of the holder due to a rise in temperature when a hot sun is shining upon it, is greater than that of the guide-framing; and undue strains are thereby induced in the guide-rollers and their carriages or supports.

Now the object of this invention is to obviate the existing defects in the construction of such carriages by introducing a flexible mechanism which is disposed in such a manner as to come into play when any desired maximum stresses are exceeded—such, for instance, as would be produced by the causes above named. This is attained by mounting each guide-roller upon a spindle working within slotted holes. A spring or springs are employed to press out this spindle to the extent allowed by the slot, which is so arranged as to give contact to the wheel with the guide-path at its widest part. The springs are so adjusted as to maintain this contact as long as the maximum stress due to wind pressure which the holder is calculated to resist is not exceeded; but if, owing to the disturbing causes described, this pressure is exceeded, the spring or springs compress and allow the spindle of the wheel to move in the slotted recess provided for it. Fig. 1 represents in side elevation, on an enlarged scale, the top carriage of the gasholder. Fig. 2 is a plan of same. Fig. 3 shows in side view (partly in section) the invention as applied to the bottom or cup of the top lift, and to the dip or top of the second lift, and also to the bottom or tank end of the lowest lift. Figs. 4, 5, and 6 are plans of the several applications showing different kinds of flexible media. Fig. 7 shows in plan view a slight modification in the form of flexible mechanism.

A represents the top lift of a telescopic holder; B, the second or subsequent lifts; and C, the tank. D represents a dip, and E a cup. F represents a guide attached to a column of the framework of the holder, and F*, a guide in the tank C. G are brackets or carriages for the wheels or rollers H; and these brackets or carriages are bolted or otherwise secured to the lifts of the holder. The brackets G have angle-pieces I attached thereto on the outside, or are formed with flanges J at right angles to the body of the bracket, as shown; and at the outer ends the brackets G are provided with slots K to receive the axles L of the wheels H. On the ends of the axles L, which project beyond the brackets G, are mounted eyes or sockets O on the end of threaded rods P; and these rods project through the angle-pieces I or flanges J, and receive lock-nuts Q Q^1 and helical springs R, the tension of which is regulated by the lock-nuts Q, while the lock-nuts Q^1 regulate the movement of the rods in a forward direction.

In fig. 4 the springs are shown as volute springs; and in fig. 6 the springs consist of india-rubber blocks. The modification shown in fig. 7 will be obvious without further explanation.

The position of the wheels or rollers H as shown is that which they would occupy when subjected to a greater strain than that which the springs would give after suitable adjustment. When the obstructions are passed, or the disturbing causes cease, it is obvious that the springs would press the axles carrying the rollers to the other extremity of the slot; and under these circumstances the carriage and guide wheel would act in the ordinary manner.

APPLICATIONS FOR LETTERS PATENT.

23,291.—Helps, G., "Gas burners and mantles." Oct. 27.
23,292.—Summerhill, E. J., "Internal combustion engines." Oct. 27.
23,303.—Douglas, G. C., "Compound gas-engines." Oct. 27.
23,304.—Kelly, J. H., "Gas-fittings for adapting incandescent light to kitchen brackets and the like." Oct. 27.
23,310.—Jones, J. W., "Coin-freeing apparatus for gas and water meters." Oct. 27.
23,332.—Grice, G., and Dewey, H., "Incandescent mantles." Oct. 27.
23,337.—Fowler, C. H., and Medley, E. A., "Gas-producers." Oct. 27.
23,413.—Dempster, R., "Manufacture of oil gas." Oct. 27.
23,423.—Nicholson, E. G., and Adams, F. W., "Internal combustion engines." Oct. 27.
23,442.—Scott-Snell, C., "Gas-burners." Oct. 27.
23,544.—Coppée, E., "Coke-ovens." Oct. 28.
23,568.—Clerk, D., "Gas and other engines." Oct. 28.
23,572.—Reeves, E. A., "Coin-controlled apparatus for delivering gas and other fluids." Oct. 28.
23,592.—Statter, J. G., "Manufacture of acetylene gas." Oct. 29.
23,705.—Allen, T. G., Jun., "Acetylene bunsen burners." Oct. 30.
23,714.—Evans, T., and Spaull, B. A., "A gas economizer and mantle preserver." Oct. 30.
23,889.—Muir, R. W., "Compound double acting gas or other engines." Nov. 1.
23,892.—Herring, W. R., "Coal-storage hoppers for inclined gas-retorts." Nov. 1.
23,928.—Müller, H., "Pressure reducing and regulating apparatus.*" Nov. 1.

The Lighting of New Palace Yard.—In the House of Commons to-night, Mr. John Ellis will ask whether the attention of the First Commissioner of Works has been drawn to the inferior quality of the gas and the imperfect lighting of New Palace Yard and the other immediate precincts of the Houses of Parliament; and whether he will consider the advisability of taking steps to effect some improvement.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by correspondents.*]

The Metric System.

Sir,—With reference to your articles on the metric system, allow me, as one who has seen the method introduced into a country, and who has had great experience with it, to state that I am not convinced that it is an ideal system or the most suitable for the working class.

Under the metric system, some of the gas companies in this country (Brazil) charge the consumer a price that cannot be represented in coins, nor can the account be paid exactly, but only approximately. The remarks in your number for Aug. 26 appear to be to the point.

A lot of nonsense is now published about England's comparative ignorance of foreign languages, and obsolete weights and measures. I have never known any business lost through these drawbacks; but I do know of many orders going to the Continent in consequence of English manufacturers ignoring instructions.

The modern system of evading the question, and beating about the bush, is most useful for political matters, but not equally so for business—more especially when a nation trained by severe discipline to grasp hard facts is competing with us.

A practical knowledge of the metric system could be acquired in France, where the people are not hampered by knowing any other method, and they could be tested as to whether they have the same sense of proportion and magnitude as people who estimate on an entirely different basis.

Rio de Janeiro, Oct. 15, 1902. Common Sense.

A New Condensing Gas-Stove.

Sir,—On Sept. 30 last, I see that Mr. Thomas Fletcher addressed you on the subject of your description of the Carron patent induction condensing gas-stove, when he makes the statement that the amount of condensation produced by a condensing gas-stove "is purely a question of size and condensing surface, as compared with the quantity of gas consumed." I now desire to point out to you that, although this statement may be correct as regards the ordinary condensing gas-stove, it is incorrect and misleading when applied to this "new condensing gas-stove," as to produce the same results in that manner, the stove would have to be about four times the size that it actually is, with the consequent increase in cost to which he refers.

As I may fairly lay claim to being the pioneer of the system of heating by gas and condensing the products of combustion, I am in a position to prove that thousands of stoves of this kind have been made and sold with sheet-iron tubes, as being more satisfactory than brass or copper, and that thousands of pounds are now being annually expended by gas companies in replacing the sheet-iron tubes in condensing gas-stoves, which they have purchased to let on hire.

As regards the relative merits of ordinary gas-fires and condensing gas-stoves, both largely depend on the degree of excellence of their manufacture; the chief drawbacks of an ordinary gas-fire being the liability to a down-draught from the chimney, and the extra cost of the gas, the heat from which is wasted by being carried away.

20, *Victoria Street, S.W., Nov.* 5, 1902. F. R. E. Branston.

High-Pressure Gas for Lighting, &c.

Sir,—There is one point which is now coming up as regards this, which will probably require very serious consideration in the near future, and which has several times recently come under my own notice—*i.e.*, the problem of adapting the necessary conditions for this to the equally necessary conditions for other applications of gas. The workshop and laboratory question as regards heating for trade and manufacturing processes, may be left out altogether. As a rule, the higher the gas pressure for these, the better the result, and the fewer cases where special blowing power will be required. We may take it that, for general trade heating use, the higher the pressure the more universal will be the use of gas as a general fuel, except as regards domestic requirements, which are, and always will be, of great importance to all gas works.

Taking first the question of lighting ordinary houses, any pressure over about 1 inch of water causes the burners to be noisy, and turning down the supply at the tap does not always improve matters. Frequently they are very much worse, owing to the fact that most (if not all) plug taps of the usual construction make an exceedingly good whistle—the noise being carried along the gas-pipe, and appearing at the burner, which usually gets credited with the nuisance. It may be mentioned incidentally that some of the flexible metallic tubing now coming largely into use, and replacing rubber tube, if used with high-pressure gas, causes a loud screaming, the tone of which varies with the air pressure so exactly that, with an arrangement of keys for supplying different pressures of air, a short length of this tube could be used effectively as a musical instrument—giving true tones like a clarionet or hautboy.

For ordinary flat-flame burners and the usual varieties which are practically necessary for passages, small rooms, and bedrooms in private houses, high-pressure gas, under present conditions, would be far too noisy for any practical purpose; and the same remark applies with equal force to the use of gas-fires. It is not a question of the burners so much as of the present form of taps used, which would have to be replaced by special screw valves—an expensive, and I feel sure a dangerous, innovation in the hands of the average untrained user.

If any attempt is made to introduce high-pressure lighting into general domestic use, this problem of noise will have to be faced, and the fault remedied; and no doubt the same difficulty will crop up in lighting rooms used for concerts and public meetings. The question of silent lighting with these burners is one I have personally little knowledge of; but I have never yet seen any really silent burner

working at any but low pressures of gas. I only raise the point now, as one which has been brought under my notice by users who have the question of high-pressure lighting under consideration, and are confronted with the difficulties likely to crop up when both systems are required on the same service, and where the total demand would not justify the extra expenditure necessary if both systems had to be used at one and the same time.

Warrington, Nov. 3, 1902. THOS. FLETCHER, F.C.S.

Gas Engineers in America.

SIR,—"Good wine needs no bush," neither is it necessary for anyone (particularly one of the "Subs.") to take up the cudgels on behalf of the management of certain of the larger gas properties in the United States. But your English readers should be set right in regard to the communication from a prominent American gas engineer in your issue of Oct. 14. Any of your readers in this country with a fair knowledge of gas affairs, both rumour and gossip, will instantly recognize the identity of the writer of the article.

The accident to which the writer referred took place in a works under the supervision of a gas engineer of the old school. An equally serious accident (as to numbers killed) took place some years ago in a works under the supervision of another prominent gas engineer.

Lack of tact and ability to "get along" with other people are failings which progressive proprietors of gas properties must consider as fatal objections to the aspirant for any of the higher positions. It may also be remarked that "push" and energy are as necessary to success as accuracy and brains. The writer is an old man who willingly stands aside for those who are better all-round men than he. The modern gas proprietor will have results; and if one cannot get them, he must stand aside for someone who can.

As to writing for the technical journals, no one ever really objected if the writer had the time to spare. It is, however, well known that our busiest, most successful, and most capable gas engineers have to confine themselves to a paper for one of the Gas Associations once in every two or three years. As to the notice of accidents by the gas papers here, there is nothing to be gained by advertising such mishaps. It is not good business; and the practice is not followed in other trades.

New York, Oct. 26, 1902. SUB.

Halifax Gas Affairs.

SIR,—I notice in your comments on the condition of the Halifax Gas Estate, that you say: "The Sub-Committee's findings have now been endorsed by the *six* independent members appointed by the Council." This is incorrect. I was one of the six, and withdrew from further service at the first meeting which the Joint Committee held.

Halifax, Nov. 6, 1902. J. WHITAKER, Councillor.

Fires and Gas-Fittings.

SIR,—I believe that we who are in the gas profession are living in the most interesting and remarkable period of the industry. It is therefore all the more our duty to be watchful. I noticed a few days ago, in the news from Birmingham, that the slot gas-meter has been receiving praise for extinguishing the gas during a recent fire that occurred in that city. I grasp the opportunity, and would call attention to a matter which has very frequently crossed my mind, and one very nearly connected with the incident placed on record. It is this: Vast strides are being made in the use of gas for manufacturing purposes. In the event of accidents happening, our competitors will scarcely fail to make use of them to our disadvantage. Large pipes must be used, and they certainly are, as at present fixed, likely to add fuel to any fire which may break out in the building they supply. I would suggest the use of some automatic contrivance to shut off the gas at the service when the gas-engine stops, or when the supply is no longer needed. I shall be pleased to hear from any of your readers who may feel interested in this matter: "To be forewarned is to be forearmed."

Manchester, Nov. 8, 1902. THOS. G. MARSH.

Prepayment Meter Law.

SIR,—The decision in the Longton Corporation case has naturally aroused much interest in the gas world; but it need not cause disquietude on the part of gas managers. It merely calls attention to the necessity of obtaining a proper contract from prepayment meter customers, which contract should make the consumer responsible for the pence placed in the money-box until the same have been collected by the officials of the company or corporation, and a proper receipt given to the consumer. It should, further, make the consumer liable for any deficiency in the money as shown by the index of the meter, whatever be the cause of such deficiency, other than fast registration. I agree, in theory, with the "JOURNAL," that favourable consideration should be given to any cases which appear to bear harshly on the consumers; but—especially in view of the absurd contention sometimes put forward, that companies ought never to make consumers bear the loss of money stolen from the meter—it is well to point out the great difficulties in the way of dealing leniently with such cases in practice.

Granting that where meters are required to be fixed in positions that afford easy access to thieves, and so do not give the consumers a reasonable chance to safeguard the contents, either the company must bear losses by robbery, or refuse to fix the meters except upon condition that the landlords of the premises will take up the liability—that is unless, the meters are required to be fixed in unsafe positions by the consumers themselves. And there is then, of course, the probability of a change of consumer. But, provided the meters be in reasonably safe positions, the occasions upon which a company can expediently relieve the consumer of liability for money stolen are more rare than is often realized. There are so many cases in which the consumer is the thief! Think of the poverty of many (of most) of the prepayment meter consumers, and then consider the temptation offered by the money box on one side of the door and the "wolf" on the other. If once you relax the severity of your rule, to require the consumer to make good the loss arising, the temptation is increased many fold. Give the people time in which to pay, if you please—and you generally must, willy-nilly—but beware how you forgive such debts. News—of that sort especially—travels among the poorer classes almost as quickly as war news does among the Kaffirs; and distinctions are odious. Every wise gas-works manager is anxious to avoid injustice and harshness, or the appearance of it; but, in the peculiar circumstances of prepayment meter supplies, it is extremely difficult to avoid being apparently harsh in a few cases, for fear of opening the door to much loss for the company and increased temptation to the consumer. The Longton judgment is being widely advertised in the East-end of London; and no doubt the companies who supply that neighbourhood will soon be aware of the fact. They will do well to see that any cases they have to take before a Magistrate in the near future are properly argued; for much mischief might be done by an adverse decision before it could be—as, if based on a contract, it certainly would be—reversed by the Higher Court.

Nov. 8, 1902. LEX.

LEGAL INTELLIGENCE.

The Limit of Time for Recovering Water-Rates.

In the King's Bench Division of the High Court of Justice, a few days ago, a Divisional Court, consisting of the Lord Chief Justice and Justices Wills and Channell, heard the case of *Elliott and Another v. Russell*, which had been stated by the Justices of Southampton, raising a question as to the time within which proceedings must be taken by local authorities to recover charges in respect of the supply of water. The following were the facts: On Feb. 13 last, an information under the Summary Jurisdiction Act, 1848, was preferred by Russell against the appellants for refusing to pay £3 3s. 9d. for water supplied by meter for the quarter ended June 5, 1901, by the Urban Sanitary Authority under the Public Health Act, 1875, although the amount had been demanded in writing more than 14 days before the date of the information. It was proved that the respondent was a collector for the Southampton Town Council, the Urban Sanitary Authority; and that from March 21, 1901, water had been supplied to the appellants for trade purposes, under three forms bearing that date, at 8d. per 1000 gallons, with a certain minimum rate. The amount claimed was calculated on the minimum rate referred to in the conditions attached to the forms. The respondent made the demand on Aug. 18, 1901. It was contended for the appellants that the time when the matter of the information arose was some day in June, 1901, and that as the information had not been laid within six months of that date, as provided by section 11 of the above-named Act, the Justices had no jurisdiction. It was urged for the respondent that the matter of the information arose on Aug. 18, 1901, and that therefore they had jurisdiction. They decided in favour of the respondent, and ordered the appellants to pay the sum claimed and costs. The Lord Chief Justice, in delivering judgment, said the only point was whether the summons was taken out too late. There was one plain ground on which they ought to decide against the appellants. There had been a demand on Aug. 18, 1901, and there was an information laid on Feb. 13, 1902, treating the matter as being a debt, and claiming the amount. The proceedings before the Magistrates were for non payment within 14 days after the demand; and the Magistrates were right in deciding that they were in time. Justices Wills and Channell concurred; and the appeal was therefore dismissed.

The Gas-Compressors at the Glasgow Exhibition.

In the Court of Session last Tuesday, Lord Low closed the records in two actions by the James Keith and Blackman Company, Limited, relative to the two gas compressing machines they provided for the Glasgow International Exhibition last year. In the one action, the defenders are the Incorporated Glasgow International Exhibition, 1901, and the sum sued for is £347 10s. 5d.; in the second, the defenders are the Corporation of Glasgow and the Exhibition, and the conclusion is for payment of £500. It is stated in the first action that, in reply to an advertisement, the pursuers offered to supply an automatic gas-compressor to be worked by water, for the purpose of lighting by gas a portion of the Exhibition grounds, on condition that they were allowed to make an exhibit of it, and to advertise it—the machine to be delivered free on rails at Arbroath, and the Exhibition authorities to bear the expense of carriage, fitting up, and attending to it. The pursuers' offer was handed to Mr. W. Foulis, who had charge of the lighting of the Exhibition, to deal with; and it was accepted. The pursuers supplied, free of charge, two automatic compressors; and they also had a skilled employee for 27 weeks to attend to them. They now charge £54 in respect of his service; £188 10s. 5d. for erecting, fitting, &c., the two compressors; and £105 for Mr. Keith's professional and personal services and attendance in connection with the lighting of the grounds. The defence is that the Engineer and Electrician to the Exhibition engaged and paid skilled attendants to look after the compressors. The defenders maintain that the first and second amounts do not form appropriate charges under the agreement, and that the item for men's time and travelling expenses is overcharged. They have offered to allow £80 for the erection and removal of the machines, and to pay the return carriage of them to Arbroath; and they repeat this offer. In the other action, the pursuers say that they offered one machine, but that Mr. Foulis insisted that he could not risk using only one, but must have the apparatus duplicated; and that Mr. Keith agreed to supply a second machine on the condition that Mr. Foulis, as representing the Corporation of Glasgow, should agree to take over both at the close of the Exhibition, at the price of £250 each. It is said that Mr. Foulis agreed to this, if they gave satisfaction. The pursuers maintain that the machines did their work well; and they

now sue for the price. The defenders deny that Mr. Foulis represented them in the negotiations. The Corporation are advised that the compressors are altogether unsuitable for use in street lighting, and would be quite useless to them. It is pleaded that there was no agreement with the pursuers; but even if one were entered into between Mr. Keith and Mr. Foulis, no authority was given to the latter to make it; and the pursuers have no right to enforce it.

The Gaslight and Coke Company Fined.

At the Bow Street Police Court, on Tuesday, the Gaslight and Coke Company were summoned before Sir Albert De Rutzen for supplying gas of less than 16-candle illuminating power. It was stated that when the gas was tested at the County Council's station in Spring Gardens on the 4th of October, it was only 15·50-candle power, or 0·5 candle deficient. Four days later it was again tested, and found to be only 15·39 candle power. The Company had given notice of appeal against the Gas Inspector's reports; but this had been withdrawn. His Worship imposed penalties and costs amounting to £5 5s.

Embezzlement by a Gas Company's Collector.

At the Southwark Police Court, on Monday last week, William John Cott, aged 33, a collector of money from prepayment gas-meters, was charged before Mr. Paul Taylor with embezzling £49 4s. 2d., belonging to his employers, the South Metropolitan Gas Company. Mr. Washington, who prosecuted, said the prisoner had been in the service of the Company for four years. Some time ago he reported that he had been robbed of £20 while watching a fire, and the Company overlooked the matter. It appeared that he had given way to betting, and he was recently at Folkestone races, where he lost a considerable sum. The prisoner said he had nothing to urge in excuse for his conduct. His Worship asked if it was true that he had given way to betting. Prisoner said it was. He was sentenced to four months' imprisonment, with hard labour.

Damage to Water-Mains by Steam-Rollers.

At the Barnet County Court, a few days ago, Sir A. Marten, K.C., heard a case in which the Colne Valley Water Company sought to recover damages from the Hendon Urban District Council for injury to a water-main alleged to have been broken by a steam roller belonging to the Council. Four bursts were found in the main within a few yards after the passing over the road of the steam roller. The Council suggested that the damage had been done by a traction engine and trucks belonging to another person, and weighing considerably more than the steam-roller; and it was pointed out that the same roller had been in use on the roads for fifteen years without causing any damage. His Honour held that the Council were liable; and he gave judgment for the Company for £7 5s. 3d., the outlay for the repair of the main, with costs.

Hexham Gas Company.—The Directors of this Company have issued their annual report and financial statement. The accounts show a profit of £2320, after making provision for depreciation of gas-stoves out on hire. The net balance available for distribution is £2175, out of which the Directors recommend the payment of the following dividends: On the original shares 10 per cent., and on the ordinary "B" shares 7 per cent., less income-tax. They also recommend the payment of £676, less tax, to the ordinary shareholders on account of arrears of dividends. These payments will absorb £1917, and leave £258 to be carried to next year's account.

Statistics Relating to the London Water Area.—In the House of Commons last Thursday, a return was ordered, on the motion of Mr. Russell Rea (Gloucester), showing the population and the rateable and assessable values of the boroughs and urban districts to be represented on the proposed Water Board for London, together with the same particulars relating to the boroughs, urban districts, and rural districts, or parts thereof, within the Metropolitan water area which are either to be excluded from that area or to be unrepresented on the Board; also the proportion which the population and the rateable value of each district bears to the total population and the total rateable value respectively of the whole of the proposed area.

Registration of Plumbers.—At the offices of the Local Government Board, last Thursday, the President (Mr. Long) received a deputation of local authorities and public health and water authorities, who desired the assistance of the Government in passing the Registration of Plumbers Bill. Mr. W. R. E. Coles (the Clerk of the Plumbers' Company) said the deputation consisted of representatives of the chief cities and towns of the United Kingdom and public health and water authorities, and included the National Health Society, the Metropolitan Boroughs, the Medical Officers of Health, and the Associations connected with plumbing. Upwards of one-third of the House of Commons had signed memorials in favour of the Bill, and more than one-half of the Members of Parliament had expressed their approval of the principle of the measure. The deputation was representative of the public interests, as well as those of the master plumbers and workmen, in the registration system. Other members of the deputation having spoken, Mr. Long said the Local Government Board regarded the measure with hearty approval; but the question was how it was to be got through Parliament. He was sorry to say that the present position of non-controversial subjects in the House of Commons was most unfortunate, and serious for the country. There had been very few sessions of Parliament during the last twenty years in which a variety of small departmental measures had not been passed into law on behalf of the Local Government Board; but he found it a practical impossibility even to carry the least contentious measure which they thought was advisable in the interests of the country. He therefore desired that the Members of Parliament present, and all those interested in the Bill, should do all that was necessary to forward it.

MISCELLANEOUS NEWS.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

The Half-Yearly Ordinary General Meeting of the Association was held last Tuesday, at the Cannon Street Hotel, E.C.—Mr. T. H. Goodwin Newton in the chair.

The Secretary (Mr. Robert W. Wilson) read the notice convening the meeting, and also the Directors' report, as follows:—

The present half-yearly ordinary general meeting of the proprietors has been convened in conformity with the Association's Acts of Parliament, for the purpose of receiving a report from the Directors upon the affairs of the Company, and of declaring a dividend for the half year ended the 30th of June last.

The following summary shows the results of the Association's operations during the half year under review: The quantity of gas made during that period was 3994 million cubic feet; the quantity made in the corresponding half year of 1901 was 3925 million cubic feet—an increase of 69 million cubic feet, or at the rate of 1·75 per cent. The total number of lights on June 30 last was 2,659,376; at the close of the corresponding half year it was 2,526,797—an increase of 132,579, or at the rate of 5·24 per cent. The number of consumers on the books at the close of the half year was 236,317—an increase in the twelve months of 17,338, or at the rate of 9·58 per cent. The total mileage of mains in use on June 30 last was 1879; at the end of 1901 it was 1840—an increase of 39.

The demand for gas during the half year was affected by the unusually mild weather which prevailed during the winter months, and the sale of gas exhibits an increase of only 2·5 per cent. The revenue derived from the sale of gas exhibited a proportionate increase of over £14,000.

The value of coke, however, suffered serious diminution; and the returns from this product for the six months ended June 30 last were £84,000 less than in the corresponding period of 1901. Notwithstanding this, the net profit of the business was only £27,000 less.

As compared with the corresponding half year, the gross cost of coal exhibited a decrease of 1s. 10d. per ton; but, owing to the decrease in the value of the bye-products, the net cost of the coal used in the half year amounted to 1s. 6d. per ton more than in the corresponding period of 1901.

The Association's agreement with the Municipality of Schönberg has been prolonged by 20 years—*i.e.*, until 1924—and contracts have been concluded for 50 years for the supply of gas to Dahlem and Nikolassee districts to the south-west of Berlin.

The Association's contract with the town of Brüx, in Bohemia, has been prolonged for 22 years; and the price of gas there has been reduced.

At Brussels, a contract for 22 years as regards gas, and for 46 years as regards electricity, was concluded with the Commune of Woluwe St. Lambert.

The Directors have also secured a 33 years' contract with Souburg, which is in the vicinity of Flushing, and will be supplied from the gas-works there.

At Vienna, a contract was concluded with Weidling—an outlying suburb—until 1911.

The plant and mains at all the stations were maintained in a due state of efficiency.

At Komotau, extensions of the retort power are in progress; four arches of eight horizontal retorts each being in course of construction.

A bench of 45 inclined retorts, removed from Erdberg, is being re-erected at Floridsdorf, near Vienna.

At the Bockenheim works at Frankfort-on-Main, the erection of four 38 ft. by 32 ft. purifiers, transferred from the Erdberg works at Vienna, was completed.

The erection of a new gasholder of one million cubic feet capacity, and of a diameter of 125 feet, with four lifts of 24 feet each, on the Koekelberg works at Brussels approached completion, and the holder will be ready for the ensuing winter.

At Komotau, a gasholder with two lifts, each 25 feet high, and of a diameter of 77½ feet, in steel tank, having a capacity of 200,000 cubic feet, is being erected.

At Prague, the new gasholder, 107 feet in diameter, with a capacity of 400,000 cubic feet and two lifts of 25 feet each, was nearly completed.

The Floridsdorf works, Vienna, which supplies those districts on the left side of the Danube in which the Association's right to supply gas is assured for some years, is being improved and enlarged; and a gasholder of 100 feet diameter, and a capacity of 350,000 cubic feet, with two lifts of 24 feet each, which has been removed from Erdberg, is being re-erected there.

Considerable extensions of the system of mains at Brüx are in progress with a view of supplying gas to a hitherto untouched portion of that town.

The Directors availed themselves of favourable opportunities of disposing of land, for which there was no further use, at Amsterdam and Vienna.

The Directors wish to record their great regret at the loss the Association has sustained by the death, on the 31st of May last, of Sir James Morse Carmichael, Bart., who had been a Director of the Association since 1891.

In conclusion, the Directors desire to draw the attention of the proprietors to the accounts for the half year ended the 30th June last. These have been duly audited; and from them the Directors have, in accordance with the Companies' Clauses Consolidation Act, prepared a scheme showing the profit of the Association for the half year applicable to the purposes of dividend. The profit falls short, by the sum of £24,087 9s. 11d., of the amount required for a 5 per cent. dividend; and the Directors propose to make good the deficiency out of the dividend equalization fund.

They accordingly now recommend the declaration of a dividend of 5 per cent. for the half year ended the 30th of June last, payable, free of income-tax, on and after Tuesday, the 11th inst.

The Chairman said that such was the account of their stewardship which the Directors placed before the proprietors that day; and he thought a very few words from him would suffice to show the real significance of the statistics of which the report was chiefly composed. The great point to note was that, however one measured it, there was still steady growth. It would be observed that the quantity of gas had increased over the quantity made during the corresponding half year by nearly 2 per cent.; the number of lights, by 5 per cent.; and the number of consumers, by nearly 10 per cent. But the proprietors would please remember that this increase of consumers included the prepayment meter consumers, who were, of course, individually but small consumers. They numbered, however, on June 30 last no less than 44,490 out of a total of 236,317 consumers. The half year under review was a complete reversal of seasons. In the first three months, when ordinarily they looked to gather the bulk of the profit of the half year, the weather was bright and mild; and, as compared with the corresponding three months of the previous

year, there was a decrease in the consumption of gas. In the last three months of the half year, the weather became kinder to them, and the whole of the leeway was made up, and the increase of nearly 2 per cent. reported obtained. To this same cause was due the diminished value of coke, which was the distinguishing feature of the half year. The report said this amounted to the huge figure of £84,000, or a falling off of 29 per cent. They might well consider the real bearing of this on their prospects in the future. He had had occasion to point out from time to time that it was not the gross price of coal which affected the profits of the gas company, but the net price—that was, coal less coke; so that, if coke showed a falling off of 29 per cent., as it did this half year, the effect on the profits was the same as if a large amount had been added to the cost of coal carbonized. Thanks, however, to economies in other departments, the diminished profit against that of the corresponding half year was only £27,000 (and that after making all proper provision for writings off depreciations, and so forth). This, they must all agree, was a matter for great satisfaction. Happily, they were now getting rid of their coke at better prices. The provision made by the Association to meet such irregularities in the profits, considering the value rightly placed on steady dividends by a large number of the proprietors, in forming the dividend equalization fund in 1898 (amounting to £369,000, which had been called upon twice since—first, in the second half year of 1901, for £17,000, and now for £24,000), admitted of similar calls for many years to come before it would be exhausted. If they could get normal prices for their coke, the fund bids fair to last a very long time indeed. Since the close of the half year, an event had occurred to which he should like to call attention, as it would be of importance to the Association in the future. This was the conclusion of a working arrangement and "pooling" of profits at Frankfort-on-Main with the Frankfort Gas Company. The Board had long been negotiating to terminate the sharp competition between the Gas Companies there, which the agreement just completed effected. The proprietors should know that at Frankfort the Association supplied common gas; the Frankfort Gas Company supplied, till 1911, cannel or high illuminating power gas; and the town supplied electric light in competition with both of the Companies. He considered all parties would benefit under this "pooling" arrangement, which contained stipulations for the ultimate amalgamation of both gas undertakings. The Board were indebted for their valuable reports to the Visiting Directors this autumn—the Deputy-Chairman (Mr. J. Horsley Palmer), and Mr. Tindall; and he (the Chairman) was particularly so in consequence of his being—temporarily, he hoped—unable to travel. Mr. Lucas, Sir Charles Jessel, and Mr. Birchenough had also made recent visits to the Continent, which had been most useful. The latest event in what might be called their domestic history was the election to a seat at the Board, in the room of Sir James Carmichael (whose death was so universally regretted), of their Consulting Engineer, Mr. Corbet Woodall, whose services, he felt sure, would be of even greater value to the Association as a Director than they had been as Consulting Engineer. The Chairman concluded by moving the adoption of the report.

The Deputy-Chairman (Mr. J. Horsley Palmer), in seconding the motion, said that, as he had only as lately as last Saturday come back from a very prolonged, and he might say, exhausting and exhaustive, tour of the Association's stations, it might be of interest to the proprietors if he gave them a few details as to what he saw on his visit. He might say he visited Brussels, Antwerp, Lille, Aix-la-Chapelle, Frankfort, Berlin, and Hanover; and at all of these stations he found the work of their great Association going on satisfactorily. At almost every station, there had been very great extensions of the business and of the plant since his last visit five years ago; and this was remarkably in evidence at such towns as Berlin, Frankfort, and Hanover. Those gentlemen who had not been there lately would have no idea of the vast extent of building that had sprung up in the western suburbs of Berlin; and therein lay, he thought, a great point of strength for the Association. And for this reason, that the Directors a few years since thought it an admirable policy to conclude extremely long contracts with what were then the country suburbs of Berlin. To-day, they were being covered with vast squares, avenues, and terraces, in exactly a similar way as South Kensington was covered at the present moment. It was, as he said, a great feature of strength to the Association that they had such immensely long contracts in the neighbourhood of Berlin, which the Association's most competent officers and bankers there predicted would become the great fashionable quarter of Berlin. There was another matter also with regard to Berlin on which a certain amount of congratulation might be allowed. It was this, that they had been able to obtain, at a very reasonable price, a very large extent of ground with railway and dock facilities; and there they had begun to erect a splendid works on the most approved system, under the personal supervision of the gentleman who, he was glad, had been elected on the Board—Mr. Corbet Woodall. These works had been acknowledged by every engineer who had visited them—either from America, or England, or any other part of Europe—as being the most model gas-works that were known anywhere; undoubtedly they are for the economical production of gas for Berlin. The same remarks applied in a somewhat less degree to Frankfort, which had also largely increased, to Hanover, and to one or two of the other stations. And let him assure the proprietors that what was very important in producing their dividends was this—that they were very ably served by the Engineers and officers in charge of their works. There was no more skilful Engineer on the Continent, and no more devoted servant of the Association, than Mr. Edward Drory, their Chief Engineer at Berlin. He was the acknowledged expert throughout Germany; and when any difficulty arose at gas-works, Mr. Drory was very frequently consulted, so that the trouble might be righted. He (Mr. Palmer) trusted these few remarks had been of interest.

The motion was carried unanimously.

On the proposition of the Chairman, seconded by the Deputy-Chairman, a dividend of 5 per cent. for the half year was declared on the £3,800,000 stock, free of income-tax.

Mr. Drew said he had much pleasure in proposing a vote of thanks to the Chairman and Directors for their services during the past hal year. It had no doubt been a very anxious time for them, as it alway was for Directors when they found the profits diminishing.

Mr. R. G. Cooper seconded the motion, which was unanimousl agreed to.

The Chairman, in the course of his acknowledgment on behalf of himself and his colleagues, said he trusted the current half year might be more to the proprietors' satisfaction than he feared the past half year had been. But, personally, he looked upon the half year with considerable satisfaction.

Mr. Arthur Lucas, in proposing a vote of thanks to the Secretary, Engineers, and other officers, said Mr. Wilson had had an exceptionally anxious time owing to the negotiations with the Frankfort Gas Company; and he (Mr. Lucas) was quite sure they were only too glad to avail themselves of this opportunity to tender to him publicly their thanks for the extremely able manner in which he put the matter before the Board, with the result that the contract was satisfactorily concluded. The Engineers also attended most ably to the conduct of their business. The information would be of interest to proprietors who had the management of works, that in not a single works of the Association had there been any labour troubles during the past twelve months. In other parts of the world—as he could say from painful experience—labour troubles were increasing daily in contradistinction to the condition of things in Germany. He was sure this state of things in their works was due to the kind, sympathetic, and liberal management of their Engineers.

Mr. C. Pigou seconded the motion; and it was heartily agreed to.

This concluded the proceedings.

NEW GAS-WORKS FOR COVENTRY.

The Scheme Adopted.

As briefly intimated in last week's "Journal," the proposal to erect a complete new gas-works at Foleshill, at an estimated cost of about £180,000, in accordance with the scheme prepared by Mr. Fletcher W. Stevenson, the Engineer (*ante*, p. 1154), was adopted without dissent by the Coventry City Council.

Mr. Rotherham, the Chairman of the Gas Committee, said it was necessary that the matter he wished to bring before them should be dealt with at once. Even as they stood now, they had not sufficient gasholder accommodation; and it was absolutely essential that the contracts for the erection of new ones should be given out at once, in order that they might be ready for use by the winter of 1904. If they could not do this, there was no doubt whatever that the supply of gas would fall short of the demand. Under these circumstances, he moved that Standing Order No. 9 be suspended so as to allow of the Council dealing with the question before it went to the Estates and Finance Committee.

This resolution having been put and carried,

Mr. Rotherham proceeded at great length to explain the position of affairs. He reminded the Council that permission to spend £130,000 for a scheme which would very shortly after its completion involve a further expenditure leading up to £150,000, had already been sanctioned; so that in placing before them a plan for the expenditure of £180,000, they must not forget the fact that they were merely suggesting an alternative scheme with an increased capital. Every speaker who had dealt with the existing state of things at the gas-works, and every expert who had reported upon them, had at once pointed out the cramped nature of the works themselves; and if the old scheme was retained, the cramped position of their works as they were now would gradually be reproduced at Foleshill. One of the great difficulties they had at Coventry was the fact that everything had to be handled twice, if not three times. He then compared the two schemes, pointing out the respects in which the new plan was superior to the earlier one. The scheme which the Council had already sanctioned was to give 1¼ million cubic feet of gas a day; but this would have to be increased, and to bring the make up to 2½ million cubic feet they would have to increase their expenditure to £150,000. With the scheme, they obtained, directly the first section was completed, a productive capacity of 4½ million cubic feet for £180,000. The great thing was that they moved their works. If they retained their Coventry works, which had a producing capacity of about 3¾ million cubic feet per day, and their output remained where it was now—viz., about 2¾ million cubic feet—and they contrasted this with the method of working in well-designed works, the saving that could be effected represented interest on £100,000. If they got up to their maximum productive capacity at Coventry, and compared that with the proposed new works at Foleshill, the saving represented interest on £140,000. In addition to this, the works, according to their contention, ought not, if possible, to be divided. They could not run works economically when half was at Coventry and the other half at Foleshill. There was also a certain portion of the population who lived near the existing gas-works, who would tell them that they were a nuisance.

Mr. Johnson: They keep away epidemics.

Mr. Rotherham; Yes; but some would prefer the epidemics. If they moved to Foleshill, the old works could be utilized in several ways. They heard talk of destructors, and the necessity of a Corporation yard for horses. The Committee were not putting forward anything like a flaming estimate of what they could do in the future. They had rather understated their case than overstated it, which he thought was the best principle. He supposed it was an open secret that the current year of the gas-works was, so far as they could see, bound to exceed last year in profits; but they had taken all their estimates on last year's basis. They preferred to look at the black side of things, and please the Council afterwards by the actual result of their working. With regard to the capital expenditure, if the members approved of this scheme the outlay was not to be made all at once. It was to spread

over some years. Very nearly £30,000 of it was upon items which would be utilized for the whole of the works when they were completed in their entirety. The Engineer had had a difficult situation to cope with all through. He had had plenty of work to do in getting to learn his new home, his new work, and his new workmen; and they could hardly ask him to set on one side such tasks as that, and confine his attention exclusively to bringing out a new scheme for moving to Foleshill. He had finished the one, and he hoped it was satisfactory. He (Mr. Rotherham) wanted to point out to them that their immediate object in coming to the Council was to get permission to go on at once with the gasholders. It might be asked, Well, why didn't you come and ask permission for your gasholders, and leave the rest? They would, however, readily see that this was impossible. They must fix the site of the holders before they got their contracts; and in fixing the gasholders, they practically fixed the scheme. The Committee wanted to place before the Council the scheme as a whole. They believed the scheme was infinitely better and infinitely cheaper than the old one; and he had much pleasure in proposing its adoption.

Alderman BOOTH remarked that after the exhaustive statement of Mr. Rotherham, he would content himself with merely seconding the proposition.

Alderman ANDREWS said that, after the very plausible and glowing speech of the Chairman of the Gas Committee, it might be thought that there was nothing to be said on the other side. He regretted that he could not support the scheme, mainly owing to the large expenditure of capital. If this £180,000 was expended, it would raise the city debt to considerably over £1,000,000—that was to say, somewhere about four times the rateable value—and it seemed to him that it would be overloading the city with debt, and financially it would not improve the credit of the place. He would much rather see a scheme with a smaller amount of capital; and here, he might say, he did not approve of the first scheme owing to the same reasons—the large expenditure of capital. If they looked at the capital employed in the construction of gas-works, they would find, unless he was very much misinformed, that they could be built complete for £60,000 for a town of moderate size. Let them take Leamington. The last time he inquired into the position of the gas undertaking there, he found that the whole of the capital sanctioned was £125,000, of which only £100,000 had been called up. But to come nearer home, take the works which supplied a population of 40,000 for many a year in Coventry. The paid-up capital at the time they purchased these works in 1884 was £100,000, £80,000 of which was in shares, and £20,000 in loans. It was true they paid a great deal more for it; but that was the actual amount of capital paid up by the shareholders and the expenditure on the works. He could not, therefore, look upon this scheme as anything but too great, or, in plain language, too extravagant. The proposal seemed to be built on the supposition or expectation that similar profits might be made in the next seven years to those which had been obtained in the last seven years. Well, he did not believe they could, unless the price of gas was kept up. The organization, and the business arrangements and methods of the Gas Committee, were, in his judgment, no longer adapted to produce those profits as they were formerly. Where was the £4000 a year surplus profit which they had regularly for years? It had vanished like a morning dream. He suggested that before they committed themselves to the scheme they might take the opinion of Sir George Livesey, who had been the Consulting Engineer to the gas-works. The hint had been thrown out by the Chairman that the current year's profits would be larger than last year's. They ought to be. It seemed to him that the time had come when the price of gas should have been reduced by 1d. per 1000 cubic feet; but the profits, in his judgment, would only be made in future by keeping up the price—by increasing it rather than reducing it to its former level. If the price was kept up or increased in order to realize profit, it would be only like jumping out of the frying pan into the fire, because it would have a tendency to drive away the cycle industry. One necessity of the staple trade of Coventry was cheap gas. The quantity used was so great that in case it was too high the trade would have a tendency to gravitate to other parts where it could be had cheaper. At present, the Gas Committee could not show any surplus profit with a capital of £240,000. Was it to be supposed that they could show any when the capital was increased to £420,000, without increasing the price of gas?

Mr. WEST congratulated the Chairman and the Gas Committee on the excellent report presented. They had been asked to obtain the opinion of another expert. He could give them the opinion of one. He thought they would agree that the late Councillor Robinson was an expert. (Alderman Andrews: No.) His opinion of the gas-works was that every penny spent by the Corporation on the old site was money thrown away, and that if the Corporation would erect new works outside the town they could manufacture gas at 6d. or more per 1000 cubic feet less than they could at the present works.

Alderman GULSON said it was admitted that they must have new gas-works; and there could be no doubt at all that the new plan was in all respects a complete one.

After remarks had been made by several other speakers,

Mr. ROTHERHAM replied to the discussion. He said although the new scheme was estimated to cost £180,000, they anticipated that they would have to spend on new mains, services, meters, and stoves an additional £25,000, to cope with the demands. With regard to the capital expenditure, as the report stated, this would compare favourably with other towns. As to the suggestion that the Council were being rushed in this matter, he submitted that there was no rush. In conclusion, he expressed his appreciation of the remarks made concerning the new Manager, and said it was a pleasure for the Gas Committee to be able to work with, and be advised by, such an exceedingly able man.

The proposition was then put to the vote, and declared carried unanimously.

Kitson System.—The United Kingdom Lighting Trust, Limited, has been formed for the purpose of exploiting the Kitson lamps throughout Great Britain; and they are taking over the Company's agencies. The business has increased so rapidly that it has been found necessary to divide it into two branches—the manufacturing and the selling. The capital of the Trust is £50,000.

THE QUESTION OF MUNICIPAL TRADING.

Towards the end of May last, a conference was held on the above subject at the Constitutional Club, under the auspices of the London Municipal Society. Sir Edward Clarke, K.C., the Chairman of the Council, presided. The question was fully discussed, and, with the view of making more widely known the opinions put forward, the Society have had the report of the proceedings printed in pamphlet form, preceded by a note containing an epitome of the evidence given before the Select Committee on Municipal Trading in 1900. The conclusion arrived at by the conference was that the Government should be urged to re-appoint the Committee. It may be of interest, in view of the additional prominence lately given to this question by the articles in "The Times," to reproduce some extracts from the introductory matter of the pamphlet.

It would appear that the advocates of municipal trading (chiefly municipal officials) place no limit on the nature and extent of municipal enterprise in trading undertakings, provided that there is a prospect of making a profit. The supporters of municipal trading range from those seeking profits to diminish the rates to Socialists, who, regardless of profit or loss, desire to put their theories into practice.

The opponents of municipal trading broadly take the position that the work of the municipality should be confined to undertakings connected with sanitary matters, or to monopolies of services or functions necessary to the whole community. They argue that such undertakings should be limited to those objects which are not only generally necessary to the whole community, but in their nature possess the attributes of monopoly. The provision of bread or boots, though a general necessity, is outside this definition, as there is no monopoly of supply; and if there existed a monopoly of supply of an article, such as tobacco, the municipality would not be justified in undertaking it, as it is not a necessity, or generally required by the whole community. It is a question of degree which needs consideration in each case. Where there is a partial monopoly of public property by a private undertaking (as in the case of the occupation of a portion of the road by tramways), the municipality may be justified in acquiring the undertaking; but in such a case many witnesses state that they would prefer public control to public management. Again, private enterprise is preferable even in the case of a trading undertaking in the nature of a monopoly, unless the municipality can manage it more efficiently. Other witnesses, while agreeing that municipalities may directly supply a natural provision, such as water, are strongly opposed to their being allowed to manufacture or supply manufactured articles.

The arguments of those opposed to municipal trading can be classified under two heads: (1) On the principle that trading is not the proper function of a municipality, is an unfair competition with the trading ratepayers, acts as a check to private enterprise and to the introduction of improvements, tends to create monopoly, and is accompanied by political dangers, especially those connected with the direct employment of a large number of employees who are electors, and often leads to corruption. (2) On financial grounds—viz., the probability of loss through the absence of the ordinary business stimulus, and the enormous addition to municipal debt, largely for the purpose of conducting speculative undertakings. In addition to these objections, it is further urged that there is considerable indirect mischief attending municipal trading arising from the neglect of the primary functions of local government, and the deterioration of the *personnel* of municipalities, owing to the large demand on the time of councillors.

The arguments in support of these objections may be thus shortly stated. The primary duties of municipal authorities were the relief of the poor; police protection; the construction, maintenance, and lighting of roads; and all matters connected with sanitation. To these duties were subsequently added the provision of certain educational facilities, and the acquisition of parks and open spaces. In other words, the proper function of a municipality is to provide for the community more healthy and elevating conditions of life which could otherwise only be enjoyed by the few. One of the main objects of the Municipal Reform Act of 1835 was to abolish the restrictions upon trade and similar abuses which had characterized municipal government. It was for this that the old corporations were reformed; and the policy of freedom for industry then adopted has led to the enormous expansion of our industrial centres. Undoubtedly, municipal trading tends to create municipal monopolies, and so to reintroduce the evils which existed prior to the passing of that Act—in fact, it defeats the very object of the Act as set out in section 14.

Municipal trading is unfair to the trading ratepayer, who finds himself in competition with a municipal rival trading with funds raised by rates to which he partly contributes, and with cheaply borrowed money secured partly on the rateable value of the property in which he carries on his business. A curious result is that in many instances the ratepayer conducts his business subject to inspection by his municipal rival. Further, municipal trading acts as a check to private enterprise and to the introduction of improvements, and tends to create monopoly. Lord Avebury, in his evidence, said: "A great deal of the improvements in many of these directions have been from new inventions and patents, and I do not think that municipalities are so likely to take them up as private investors are. . . . I think that the tendency of what has been done [by municipal trading] has been to check the development of electrical enterprise in this country very much." Mr. Sydney Morse said: "Has your attention been called to the large number of Provisional Orders which have been obtained by municipalities, and remain up to the present time blank Orders?" The witness said: "Yes; we find in a very large number of cases that municipalities have really taken Orders to block the field." Again, on the question of competition and check to progress, Mr. Morse said: "We find that a municipality having gas-works opposes electric lighting very often on the ground that it will seriously affect the money invested in the gas-works by the municipality, which has been obtained on loan from the rates." Lord Avebury asked: "Would you say that the possession of a gas enterprise by a corporation would tend to prejudice them

against the introduction of any electric light scheme?" The witness answered: "That is certainly my impression. . . . I was Chairman of the Edison and Swan Company at one time, and certainly my impression was that we then had greater difficulties in dealing with municipalities which had invested in gas, because they thought we were introducing a competing light, and interfering with the value of their property."

Another instance was given by Mr. Dixon Davies. The General Power Distribution Bill of 1897, which had for its object the establishment of a central generating station to supply electric power for manufacturing purposes in a large area in the Midlands, including Nottingham, Sheffield, and Doncaster, was vigorously opposed by several of the important corporations in the proposed area of supply. The Association of Municipal Corporations organized opposition to the Bill; and by moving many corporations not interested to bring pressure to bear upon their Members of Parliament to oppose the Bill, obtained its defeat.

These instances show how pernicious and unjust is the action of municipalities in the protection of their vested interests, which has resulted not only in a considerable check to industrial enterprise and invention, but has also deprived manufacturers of the much cheaper motive power which would have been provided. That it is the tendency of municipal trading to check private enterprise, retard the introduction of improvements, and create a monopoly, is clearly proved by a resolution passed by the Municipal Corporations Association: "That this Association affirms the principle that where local authorities have, with the sanction of Parliament, established, or are in course of establishing, undertakings for public benefit, and have not failed in their duties, it is not right or expedient that powers should be granted to companies to compete with them."

With regard to the point that municipal trading is accompanied by political dangers, especially those connected with the direct employment of a large number of employees who are electors, and often leads to corruption, the danger is twofold. There is the temptation to the municipal candidate to make a bid for votes by promising to directly employed electors better conditions of employment, such as higher wages and shorter hours; and the inducement of the employees to collectively promise their votes to the candidate who offers the highest pecuniary bid. Lord Avebury said: "There seems to be an intrinsic difficulty in members of municipalities settling the wages of their own constituents. I put it forward certainly as being a reason, and a strong reason, why municipalities should not be involved in transactions of this kind, unless there are very overwhelming reasons to the contrary." Lord Avebury referred to a poster issued in support of a municipal candidate, "Vote for ———, who would pay the scavengers a higher rate of wages." A later instance of a similar kind occurred at the General Election of 1900, in Bermondsey, where a leaflet was circulated asking the electors to vote for the Radical candidate, "who fought for and secured the 10-hour day and better wages for the tramway men." Sir T. Hughes, a Liverpool alderman, although an advocate of municipal trading, said: "I do feel that there is a danger in municipalities having so many undertakings, thereby creating a very great number of employees who might become a danger. . . . I should not regret if it were made part of the conditions that a man taking an employment in a municipality should not exercise his vote for municipal purposes while so employed. I have known an instance where combination was the occasion of a very good man being thrown out of his position as a councillor simply because they thought he did not favour that particular class." Mr. James Kelly, a Magistrate of Glasgow, said: "I think in Glasgow the risk [attaching to the increasing number of municipal employees] is very considerable. . . . They do exercise influence in the wards in which they are mostly located, and some of the candidates who stand for election make a point of bringing before the voters the special claims of the employees of the Corporation."

The objections to municipal trading on financial grounds are, as already mentioned, the probability of loss through the absence of the ordinary business stimulus, and the enormous increase of municipal debt. With respect to the first, apart from the absence of the stimulus of individual gain, without which it is not possible to get that close consideration of detail and study of improvement upon which financial success so entirely depends, the great demand on the time of municipal councillors precludes the devotion of sufficient consideration to the principal municipal problems, which are of great complexity and difficulty, and also prevents men engaged in business and professions from entering into municipal life. Lord Avebury said: "I could not help feeling, when I was a member of the London County Council, very often from the necessity of the case, having so much to do, we were obliged to come to decisions without having the time or opportunity to give them all the consideration they deserved; and, of course, the more you pile business upon the London County Council and the other municipalities, the more you increase that difficulty."

As to the second point, the rapid growth of municipal debt is shown by the following figures: In the year 1874-5, the gross amount of outstanding loans was £92,820,100; whereas in 1898-9 it was £276,229,048. The outstanding loans of local authorities had therefore increased by £183,408,948, or 197·6 per cent., in 1898-99, as compared with 1874-5. The amount of debt per pound of rateable value was about 16s. in that year, and £1 12s. 1d. in 1898-9. Nearly one-half of this outstanding debt has been incurred in connection with municipal trading. The debt of London in 1900-1 was £54,243,724. The debt involving a charge on the rates has increased from £32,767,797 in March, 1889, to £45,641,887 in March, 1901. So large a proportion of the municipal debt being incurred for the purpose of carrying on speculative undertakings must materially affect the rate of interest at which municipalities can obtain loans, and will thus deprive the municipal trader of almost his only advantage over the private trader. Lord Avebury said: "We have seen that of late the tendency has been for the rates made by municipalities to be increased, partly, no doubt, as I venture to think, owing to this tendency to engage in these commercial operations."

Other objections to municipal trading are dealt with in the report of the conference.

ELECTRIC LIGHTING NOTES.

A Breakdown in Paris.

The Paris Correspondent of the "Daily Express" sent to that paper last Thursday an account of an accident which occurred on the evening of that day at Edison's electric power station in the Rue du Faubourg Montmartre, and plunged the central district of Paris in darkness. At a quarter past five, at which hour the cafés are usually crowded with people, the electric light suddenly went out, and the proprietors had to improvise lighting arrangements in the usual way—by sticking candles in the necks of bottles, and so on. He says it was a curious sight to watch the customers sipping absinthe by the light of candles.

Corporations and Electric Fitting Work.

Barnstaple seems likely to afford an interesting case, in which the powers of corporations in regard to electric lighting undertakings will be put to the legal test. The fiat of the Attorney-General having been obtained, the High Court has issued a writ at the instance of Mr. C. E. R. Chanter, a ratepayer, seeking to restrain the Town Council, in connection with their electric light undertaking, from wiring houses or supplying lamps to consumers. The Corporation some time ago issued a circular offering to undertake this work; and it is said that a good deal has been done. It is contended that this is in excess of the powers granted by the Barnstaple Electric Lighting Order.

Birkdale Street Lighting Strongly Criticized.

At the monthly meeting of the Birkdale District Council last Tuesday, Mr. Stowe asked who was responsible for the miserable lighting of the roads. He considered that the electric light was disgraceful, and the incandescent gas-light much better. In Liverpool and Southport, night looked like day; but in Birkdale they had a most wretched light, and people were grumbling all round. Ratepayers had asked him why the light was so bad, and he asked for an explanation. Mr. Hartley thought the previous speaker had just cause for complaint. The electric lights were unworthy of the name, for they simply cast a ghastly glamour in their immediate vicinity, and did not give a proper illumination of the thoroughfares. The incandescent gas-lamps were decidedly superior. Mr. Wells said the electric light was anything but creditable to those who supplied it, and he thought there was a great deal of room for improvement. It was a very poor light, and not nearly good enough. Mr. Stowe said the lights in the road were a disgrace to Birkdale. Mr. Betham remarked that the electric light was a free gift, but it was a bad one at that. He thought that with a little more pressure on their electric lighting friends in London, they would get some improvement before long. They had done the best they could; and he trusted that in the course of a few months things would be satisfactory.

CROMER WATER ARBITRATION.

WESTMINSTER PALACE HOTEL.—Saturday, May 10.*

This was an arbitration to determine the price to be paid by the Cromer Urban District Council for the undertaking of the Cromer Water Company. Mr. E. M. Eaton, M.Inst.C.E., was Arbitrator for the Company, and Mr. Henry Rofe, M.Inst.C.E., for the Council. Mr. A. J. Ram, K.C., officiated as Umpire. It was agreed between the parties that the Solicitors and their clients should attend and tender such evidence as the Arbitrators should, by previous requisition, require; but that no Counsel should be employed on either side, and no independent expert evidence should be called beyond that required by the Arbitrators. Accountants were to be appointed by the Arbitrators to summarize the figures over a number of years, and attend the meetings so as to tender any explanation asked for by the Arbitrators. If any matter of controversy arose at the first meeting, which the Arbitrators (or either of them) required argued or dealt with by further evidence, there should be an adjournment, and the parties should be left discretion as to the employment of Counsel and the attendance of witnesses at any adjourned meeting.

Mr. Harry G. Pritchard (of Messrs. Sharpe and Co.) appeared on behalf of the Company; and Mr. C. H. W. Johnson (of Messrs. Torr and Co.) represented the Council.

Mr. Pritchard said the proceedings were held under a purchase clause which was inserted in the Cromer Water Company's Act of 1901, which stated that, failing agreement, the price should be determined by arbitration in accordance with the provisions of the Lands Clauses Acts. The Council were to take over the mortgage debt; but all other debts and liabilities were to be discharged by the Company. The Council were to pay the cost of the Act, and of the winding up of the Company, as well as the compensation to the officers; but, of course, these matters would not be dealt with in the award. No definite claim was put forward by the Company; both parties having agreed that the fixing of the value of the undertaking should be left entirely in the hands of the Arbitrators, without a suggestion being put forward by either side.

Mr. *Peter Hansell*, the Clerk to the Company, in answer to Mr. Rofe, said that between March, 1897, and March, 1902, a reserve fund had been accumulated amounting to £1276, practically the whole of which was invested in funds. During this period, the Company had not paid their maximum dividend. The fund was created under the original Provisional Order.

Mr. Rofe said he did not know whether there was any claim for back-dividends; but clearly the Company could not have the amount in back-dividends and reserve fund too.

Mr. Eaton remarked that the fund was, in effect, an accumulation of revenue balances; and it was to be retained by the Company.

* A reference to these proceedings appears to-day in "Editorial Notes."

Mr. *Samuel Wood*, of Messrs. Lass, Wood, and Drew, said he had prepared statistics relating to the accounts of the undertaking, on behalf of the Council and the Company. The capital authorized by the Provisional Order of 1882 was £10,000 in "A" 10 per cent. shares and £10,000 in "B" 7 per cent. shares, together with £5000 of borrowed money. The whole of this capital had been raised. In addition, the Act of last year gave the Company power to raise £79,000 in 7 per cent. ordinary or 6 per cent. preference shares, and to borrow £28,000 more. None of this capital had, however, yet been issued. The debenture stock, which was to be taken over by the Council, was covered by a trust deed, and was repayable on Sept. 29, 1942, or at any previous date, on giving six months' notice in writing. The capital expenditure up to March 31 last amounted to £24,403. In the years 1897-8, the Company wrote off capital expenditure on meters and services a sum of about £300; but the reason for this was not stated. The sum paid up to March on account of last year's Act was £912; but this was not the total cost. Turning to the revenue and net revenue accounts, the balance of profit for each of the five years ending March 31 last was as follows: 1898, £1601; 1899, £1523; 1900, £1945; 1901, £2435; and £1902, £2659. The expenditure for the same years was £708, £1153, £1101, £970, and £1057. Some of these totals, however, included special charges. For instance, in 1899 the item of maintenance and repair of works and reservoirs, £218, included the cost of clearing out the borehole and cleaning the reservoirs and water-tank; while in 1898 and 1899 there was an exceptional expenditure of £31 and £102 respectively for analyzing the water, and in 1900 there was an item of £250 for opposing the Midland Railway Company's Bill. Then, of course, the cost of pumping was affected by the price of coal. This ranged from 15s. 7d. per ton in 1898 to 25s 5d. in 1901 and 20s. 8d. in 1902. The next table showed the capital expenditure and revenue, income, and expenditure per 1000 gallons pumped, and the percentage of expenditure on income for the past five years. In 1898, the quantity of water pumped was 33,672,000 gallons; and the capital expenditure amounted to 12s. 9·5d. per 1000 gallons. In 1899, the figures were 36,000,000 and 12s. 8·2d.; in 1900, 40,000,000 and 11s. 6·7d.; in 1901, 43,000,000 and 11s. 0·6d; and in 1902, 47,317,000 and 10s. 3·8d. The net water-rental (after deducting bad debts) for the same years was £2308, £2657, £3045, £3391, and £3701 respectively; the total income being £2309, £2676, £3046, £3406, and £3716, and the profit available for dividend £1376, £1291, £1722, £2205, and £2458. This was followed by a dissection of the water-rentals for each of the five years in each of the four districts of the Company, under various headings; while the last table showed the liabilities and assets of the Company to March 31 last. In addition to the £25,000 of capital issued, there was an amount of £749 received in the shape of premiums on the "B" shares. The capital expenditure, as shown by the Company (including £912 on account of the cost of last year's Act), amounted to £24,403; so that, according to the books, there was unspent capital to the extent of £1345. Since the Company secured their Provisional Order in 1882, the full dividend of 10 per cent. had never been paid on the "A" shares; and in eight of the years they had received nothing. At March 31 last, therefore, there was a very large accumulation of arrears of dividend (amounting to £11,763) on these shares. On the other hand, the "B" shares appeared to have received their full dividend of 7 per cent. since the time they were issued. The bulk of the arrears arose between 1883 and 1892, during which period the Company only twice paid a small dividend on the "A" shares. The Company were apparently quite within their rights in apportioning the amount of dividend between the two classes of shares in the manner they had done.

Mr. *J. K. Frost*, the Clerk to the District Council and Manager of the Water Company, said he had prepared some figures in corroboration of the quantity of water pumped, as stated by Mr. Wood. He handed in various analyses which had been made of the Company's water; but he said he had had no analysis of the town water made since 1899. The chlorine was then given at 2·952 grains per gallon; and he had no reason to believe this amount had since increased. At any rate, the Medical Officer of Health had not drawn his attention to any alteration in the water; and if any change had taken place, he would have expected him to do so.

Mr. ROPE remarked that he would like another analysis taken, so that they might be absolutely certain of the quality of the water at the present time.

Witness (continuing) said, with reference to the writing off of the meters and services, that he believed in the early history of the Company these were put in free of charge, and later on the Directors thought it proper to write the amount off. Since the time when this sum was written off capital account, the consumers had paid for the services. With regard to dividend, the capital was issued on the understanding that both the "A" and "B" shares should rank equally up to 7 per cent. During last summer there was ample water in the well with which to supply the town.

Mr. *J. C. Melliss*, M.Inst.C.E., the Consulting Engineer to the Company, described the position of the works. With reference to the question of chlorine in the water, he said that if he had had any reason to suspect that there was any sea water coming into the headings, he should have warned the Company of the danger at once, and have had an analysis made; but he felt confident there was no risk of this. The pumping-station was an old building recently enlarged. It comprised an engine-house, a boiler-house, and a coal-store; and it was erected about 1877. The engine-house, however, was extended in 1892, when the additional well was put down. There was also a manager's house on the ground. The first well and borehole had been abandoned; but another was put down in 1877. This latter comprised a brick well 127 feet deep, and a 12-inch borehole lined for 172 ft. 9 in.; with a further depth of 60 feet unlined into the chalk. Then there was the new well sunk in 1889, which was lined with iron cylinders, and was 183 feet deep, with a borehole 40 feet deep into the chalk. Besides this, there were 796 feet lineal of headings, 4 feet wide and 6 feet high, in the chalk, connecting the second borehole with the new well. Since 1898, when the headings

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1268.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 15	10½	Alliance & Dublin 10 p.c.	18–19	−½	5 10 6
100,000	10	,,	7½	Do. 7 p.c.	12½–13½	..	5 11 1
300,000	100	July 1	5	Australian 5 p.c. Deb. .	100–102	..	4 18 0
200,000	5	May 14	6½	Bombay, Ltd. . . .	6–6½	..	5 0 0
40,000	5	,,	6½	Do. New, £4 paid	4½–4¾	..	5 9 5
380,000	Stk.	Aug. 14	12	Brentford Consolidated	248–253	−1	4 14 10
270,000	,,	,,	9	Do. New . . .	180–185	−2	4 17 3
50,000	,,	,,	5	Do. 5 p.c. Pref. .	125–130	..	3 16 11
206,250	,,	June 17	4	Do. 4 p.c. Deb. .	111–114	..	3 10 2
220,000	Stk.	Sept. 11	10⅝	Brighton & Hove Orig.	207–212	..	5 1 5
246,320	,,	,,	7⅛	Do. A. Ord. Stk. .	152–157	..	4 18 9
460,000	20	Sept. 26	10	British.	39½–40½	..	4 18 9
50,000	10	Aug. 14	12	Bromley, Ord. 10 p.c. .	22–24	..	5 0 0
82,850	10	,,	9	Do. 7 p.c. . . .	18–20	..	4 10 0
500,000	10	Oct 15	7	Buenos Ayres (New) Ltd.	10–10½	..	6 13 4
250,000	Stk.	June 24	4	Do. 4 p.c. Deb.	93–95	..	4 4 3
150,000	20	July 11	8½	Cagliari, Ltd. . . .	21–23	..	7 3 6
100,000	10	Sept. 26	10	Cape Town & Dis., Ltd.	14½–15¼	..	6 9 0
50,000	50	Nov. 3	6	Do. 6 p.c. 1st Mort.	53–55*	..	5 9 1
550,000	Stk.	Oct. 15	12½	Commercial Old Stock	260–265	..	4 14 4
251,875	,,	,,	5½	Do. New do. .	200–205	..	4 12 8
271,875	,,	June 12	4½	Do. 4½ p.c. Deb.	130–134	..	3 7 2
800,000	Stk.	May 28	9	Continental Union, Ltd.	138–143	..	6 5 10
200,000	,,	,,	7	Do. 7 p.c. Pref.	138–143	−2	4 17 11
575,000	Stk.	Aug. 28	5½	Crystal Palace Ord. 5 p.c.	118–123	..	4 6 8
60,000	,,	,,	5	Do. 5 p.c. Pref. .	120–125	..	4 0 0
106,158	,,	July 11	5	Do. 5 p.c. Deb. Stk.	138–141	−1	3 10 11
486,090	10	July 30	10½	European, Ltd. . . .	17½–18½	..	5 13 6
354,060	10	,,	10½	Do. £7 10s. paid	13–14	..	5 12 6
15,243,200	Stk.	Aug. 14	4	Gas-light and Coke { 4 p.c. Ord. . .	88–90	..	4 8 11
2,600,000	,,	,,	3½	3½ p.c. max. .	88–90	−1	3 17 9
3,799,735	,,	,,	4	4 p.c. Con. Pref.	109–111	+1	3 12 1
4,193,975	,,	June 12	3	3 p.c. Con. Deb.	92–94	..	3 3 10
70,000	10	Oct 30	8	Hongkong & China, Ltd.	14½–15¼*	..	5 3 3
3,800,000	Stk.	May 14	10	Imperial Continental .	206–208	+1	4 16 2
473,600	Stk.	Aug. 14	3½	Do. 3½ p.c. Deb. Red.	69–101	..	3 9 4
561,000	Stk.	Aug. 28	10	Liverpool United A .	226–228	..	4 7 9
718,100	,,	,,	7	Do. do. B .	165–167	..	4 3 10
306,083	,,	June 24	4	Do. do. Deb. Stk.	116–118	..	3 7 10
75,000	5	June 12	5	Malta & Medn., Ltd. .	4½–4⅝	..	5 5 3
560,000	100	Oct. 1	5	Met. of 5 p.c. Deb.	104–108	..	4 12 7
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	102–104	..	4 6 7
541,920	20	June 12	5½	Monte Video, Ltd. . .	9–10	..	7 0 0
1,515,892	Stk.	Aug. 8	4½	Newc'tle & G'tesh'd Con.	104–105	−½	4 5 9
346,855	Stk.	July 4	3½	Do. 3½ p.c. Deb.	99–100	..	3 10 0
300,000	Stk.	—	8	Oriental, Ltd. . . .	—	..	—
60,000	5	Sept. 26	7	Ottoman, Ltd. . . .	6½–7	..	5 0 0
					* Ex div.		

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
851,070	10	Oct. 15	7	River Plate Ord. . .	10–10½	+½	6 13 4
300,000	Stk.	June 24	4	Do. 4 p.c. Deb..	92–94	−1½	4 5 1
250,000	10	Sept. 26	8	San Paulo, Ltd.. . .	11⅛–12½	..	6 8 0
135,000	Stk.	Sept. 11	10	Sheffield A	236–237	..	4 4 0
209,984	,,	,,	10	Do. B	236–238	..	4 4 0
523,498	,,	,,	10	Do. C	234–236	−1	4 4 9
6,000,000	Stk.	Aug. 14	5⅓	South Met., 4 p.c. Ord.	121–124	−½	4 6 0
1,700,000	,,	July 11	3	Do. 3 p.c. Deb. . .	91–93	..	3 4 6
380,940	Stk.	May 14	5	Southampton Ord. . .	102–106	..	4 13 4
87,950	,,	July 11	4	Do. 4 p.c. Deb.	102–105	..	3 16 2
120,000	Stk.	Aug. 28	6	Tottenham and Edmonton { A. 5 p.c.	118–123	..	4 17 7
300,520	,,	,,	4½	B. 3½ p.c.	52–95	..	4 14 9
182,380	10	Jan. 16	5	Tuscan, Ltd.. . . .	7–8	..	6 5 0
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	96–98	..	5 2 0
230,000	5	Aug. 14	5⅓	West Ham, 10 p.c. . .	10–11	..	4 6 4
172,000	10	,,	6⅔	Do. 7 p.c. . .	13½–14½	..	4 9 8
				WATER COMPANIES.			
780,599	Stk.	June 24	11⅓	Chelsea, Ord. . .	300–310	..	3 14 2
150,000	,,	,,	5	Do. 5 p.c. Pref. .	152–157	..	3 3 8
160,000	,,	,,	4⅔	Do. 4½ p.c. Pref. '75	140–143	..	3 2 11
175,785	,,	Sept. 26	4½	Do. 4½ p.c. Deb. .	137–142	..	3 3 5
1,720,560	Stk.	Oct. 15	8	East London, Ord.. .	211–216	..	3 14 1
654,740	,,	June 12	4½	Do. 4½ p.c. Deb. .	142–147	..	3 1 3
1,282,913	,,	,,	3	Do. 3 p.c. Deb. .	97–99	..	3 0 7
700,000	50		8	Grand Junction { 10 p.c. max..	110–115	..	3 9 7
310,000	Stk.	Sept. 26	4	4 p.c. Deb..	125–130	..	3 1 7
708,000	Stk.	Aug. 14	14	Kent	285–295	..	4 14 11
160,000	,,	,,	7	Do. New, 7 p.c. max..	195–205	..	3 8 4
1,043,800	100	June 24	11	Lambeth, 10 p.c. max..	290–300	..	3 13 4
406,200	100	,,	8½	Do. 7½ p.c. max..	210–220	..	3 17 3
350,000	Stk.	Sept. 26	4	Do. 4 p.c. Deb..	125–130	..	3 1 7
500,000	100	Aug. 14	12⅝	New River, New Shares	385–395	..	3 4 9
1,000,000	Stk.	July 30	4	Do. 4 p.c. Deb..	125–130	..	3 1 7
902,300	Stk.	June 12	7	South-wark and Vauxhall { Ord. . . .	195–200	..	3 10 0
126,500	100	,,	7	7½ p.c. max.	182–185	..	3 15 8
489,200	Stk.	,,	5	5 p.c. Pref.	152–157	..	3 3 8
1,019,585	,,	Oct. 15	4	4 p.c. A Deb.	123–128	..	3 2 6
1,155,066	Stk.	June 12	10	West Middlesex. . .	270–280	..	3 11 5
200,000	,,	,,	4½	Do. 4½ p.c. Deb. .	139–144	..	3 2 6
200,000	,,	Sept. 11	3	Do. 3 p.c. Deb. .	95–97	..	3 1 10
					* Ex div.		

were last extended, the water had been found sufficient. As, however, Cromer was growing so fast, the Company had been advised to select another site for sinking a well; and, acting on the opinions of geologists, one at Metton had been finally selected. In the third well there was a set of three-throw pumps driven by a 16-horse power horizontal steam-engine. These pumps could lift 12,000 gallons per hour, and were really capable of doing all the work that was required. There was a duplication of machinery up to a certain extent; and as there were three-throw pumps in use, there was not much risk in respect to getting out of order. Then there was also another safeguard in the case of a breakdown—namely, the 9-inch borehole pump, which would furnish them with 6000 gallons per hour; and besides this there were two storage reservoirs. The borehole pump was driven by a 10-horse power horizontal steam-engine. There were two boilers; but one of them did the whole of the work, though it would not do so if both engines were running. A 7 inch Venturi meter had recently been put up in connection with the works. The two service reservoirs stood on half-an-acre of freehold land situated about 100 feet above the town. One of these was built of cement concrete lined with blue brick; its capacity being 625,000 gallons. The other was a brick reservoir containing 120,000 gallons. The storage was thus 725,000 gallons; while the largest quantity consumed in any one week was 227,000 gallons. Both these reservoirs were covered. The Company had also acquired a site 230 feet above the town for the construction of another reservoir in connection with the new works at Metton; and the capacity of this was to be 1,000,000 gallons. It having been found that the pressure was not sufficient to distribute the water to the distant parts of the district, a tower was constructed covered with a tank containing 50,000 gallons. Either of the engines or pumps would throw the water up to this tank. There were 19,563 yards of mains, most of which were comparatively new, while all were in very good condition. The water did not seem to affect the inside, nor the ground the outside, of the pipes. The mains now extended beyond Cromer town away to Suffield Park and right up to the Great Eastern Railway Station on the south, to Sidestrand on the east, and to Runton on the west. There was very little 3-inch main; practically they were 4-inch and 6-inch. He would now turn to the new pumping-station at Metton. The Company had acquired there an acre of freehold land, with the necessary easements, for the construction of a well and pumping-station, and also the right to drive headings under any adjacent lands belonging to the Felbrigg Hall Estate, which gave them a very good margin. An 8-inch trial borehole had been put down 203 feet deep into the chalk; and it yielded by test pumping 50,000 gallons of water in 24 hours, without any reduction of the head of water which rose to the surface. This water had been analyzed and pronounced to be of good quality.

Mr. PRITCHARD pointed out that in the accounts for the last two years there was an item "Rent of adits (estimated), £25." These adits were first driven ten years ago; but no actual agreement was at that time come to with the landowner. Now, however, the Company had to pay £50 for the past two years' rent; and they had also agreed to purchase for £125 the perpetual rights of making and using the adits. The rent therefore came to £5 a year for the last ten years; and not £25 a year for 1901 and 1902. It ought really to have been set off year by year. The Company would pay the £125 agreed upon; and under the Act of last year they would also pay £730 for the site for the new pumping-station and reservoir, as well as the right to drive adits under a very considerable area at that place.

Mr. JOHNSON said there were two points he would like to mention arising out of Mr. Melliss's evidence. With regard to the Venturi meter, this was purchased for the purpose of the arbitration, and would be paid for by the Council. The other matter related to the sufficiency of the works. He thought he was right in stating that the primary object of the new works was rather to ensure a sufficient supply at the present time than with a view to future requirements. He believed there was no dispute that the works as they stood could not guarantee an efficient supply.

Mr. EATON said he was not for a moment prepared to admit that. During the three "season" months of last year the greatest strain came upon the Company that they had ever had; and they fulfilled all their obligations, without ever drawing the water below 13 feet from the bottom of the well. Therefore he contended that, at the date of the notice to treat, there was an ample supply of water to meet all the statutory obligations of the Company, and something in reserve.

Thursday, Sept. 18.

As the result of some conversation at the commencement of the sitting to-day, it was agreed between the parties that Mr. Ram should sit with the Arbitrators, and that any evidence given should be taken as having been given before him as Umpire; each party reserving the right to bring further evidence before him if a difference should arise between the Arbitrators, and he had therefore to sit again alone as Umpire. Subsequently, evidence was tendered regarding five points upon which the Arbitrators had, since the last hearing, indicated that they desired further evidence.

Mr. *Francis Sutton*, F.I.C., F.C.S., said he had made two analyses of the water since the adjournment—one on Sept. 8, and the other on Sept. 16—and he had also made an analysis on June 12. In the analysis on June 12, he gave the chlorine as 2·90 grains per gallon, and the magnesia as 1·16; while on Sept. 8 the chlorine was 3·10 grains and the magnesia 2·67, and on Sept. 16 the chlorine was 2·85 grains and the magnesia 1·76. The variations in these quantities did not convey anything in particular to his mind. He had no doubt whatever that this was a very high-class water for domestic purposes; and notwithstanding the continuous pumping for fourteen days which had taken place, there was no influx of sea water into the well.

Mr. *Melliss*, recalled, handed in tables giving the results of fourteen days' test pumping from Aug. 31 to Sept. 14. He should say that the result of the test was a yield of 155,000 gallons a day, in round figures; but when a gauging was taken four years ago the yield was

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210,000 gallons a day. The yield had therefore suddenly fallen off; but this was quite an ordinary occurrence, and was no doubt owing to the recent small rainfall. Since the works were erected in 1877, there had at no time been a failure of the supply. The old works were as yet amply sufficient for the needs of Cromer; and when the new works were completed, they were not likely to become obsolete or useless. Even the yield of 155,000 gallons a day would be a sufficient supply if the waste of 20,000 gallons daily through imperfect house fittings had been stopped; and, moreover, the yield could have been easily augmented by driving further headings. Instead of this, however, nearly 2,000,000 gallons of water had been obtained from the trial borehole at the new site at Metton between Aug. 16 and Sept. 13. Assuming the summer population to be 10,000, and the consumption 15 to 18 gallons per head per day, a maximum supply of 180,000 gallons daily would be ample; and there would be no difficulty whatever in obtaining this quantity, and even more, at a very small outlay, from the existing works, without the slightest risk of any contamination by sea water. There had been a complaint from one of the hotels that they could not get a proper supply of water in the day time; but this would be rectified as soon as the new reservoir was built. The waste at present amounted to about 2 gallons per head per day of the summer population; and this could be easily stopped. The estimated cost of the works to be carried out at Metton was £26,000, or, including the expense of obtaining the Act last year, £30,000. The present plant could be duplicated at an outlay of £2000 or £3000; and the headings at the present works could be extended at a cost of £300 to £400. To be on the safe side, they might say £4000 or £5000 would cover everything.

Mr. *Hansell*, recalled, said that building was going on all over the Company's area of supply; and the population would undoubtedly increase. Between 1891 and 1901 the permanent population of Cromer had increased over 50 per cent.; and not only was the number of houses increasing, but the assessments were also rising. The present number of services was 935. The Company were now charging a little below the maximum authorized rates for water.

Mr. PRITCHARD said what he claimed was this: The accounts which Messrs. Lass, Wood, and Drew had tabulated showed that there was an increasing revenue available for dividend, and that for the twelve months ending March 31 last the sum was £2458, while the maximum dividends required only £1700. This showed that there was earned last year a sum of £758 more than was necessary to pay the maximum dividends. Further, there were back dividends due to the shareholders amounting, when these accounts were made up, to £11,763; but since the publication of the table £1200 had been paid off under this head, leaving a balance of £10,563 due. All he could claim, of course, was what the shareholders could get from the undertaking, which was the maximum dividends and the payment of the back dividends. The revenue required in order to pay these sums was more than fully secured; and therefore he contended that the Company should receive the highest value ever given in these cases. The Company were at the present moment paying maximum dividends; and as the revenue showed that they were earning more than was necessary for this purpose, the case became a very simple one—the only question being as to whether they were able to maintain this revenue. The present revenue would be maintained if the demand for water continued, and if the Company were able to meet this demand; and there was no doubt that the demand would not only be continued, but would be vastly increased. This was shown, first, by Messrs. Lass, Wood, and Drew's tables, which throughout indicated an increase in the supply; and, secondly, the number of consumers was growing. He had shown that the population of Cromer itself had increased 50 per cent. in the last decade; and, in addition to this, there were new areas included in last year's Act which were now either absolutely unsupplied with water or only very partially supplied by the Company. These latter were places which were growing rapidly. The Company had also power to supply in bulk, which might turn out of considerable value. Then, with regard to the question of supply, the two sources were the works at Cromer and the authorized works at Metton. The works at Cromer, it was alleged, were not sufficient to enable the Company to supply the necessary water to earn the revenue; but if this were so, they could be increased at an outlay of £5000. It might perhaps be contended that this £5000 should therefore be deducted from the value of the undertaking; but this was not so. Although the Company did not hand over the works completed by having had this sum expended upon them, they handed over the money itself. They did not transfer £5000 in capital, but a balance of revenue which very much exceeded this. They handed over a balance of revenue of more than £700 at the present time; and £700 a year was worth very much more than £5000. So that, putting aside all question of increase in the future, if Cromer stood where it now was, the Company could, without the shareholders losing a penny, have added to their headings and put down further pumping plant to make it absolutely certain that they would have sufficient water. Therefore, even if the new Act was disregarded altogether, the Company could have absolutely secured their revenue. On the other hand, if last year's Act was taken into consideration, the Company had obtained valuable powers in regard to Metton, and had acquired the land and easements at a ridiculously low price. Referring again to the £700 balance of revenue, in the ordinary course this would be at least £1000 next year, because it was increasing at the rate of between £200 and £300 per annum. Well, £1000 was equal to interest at 5 per cent. on £20,000; so that if the Company chose to spend £20,000 of capital next year, they could do so and still pay the maximum dividends. Of course, the works at Metton would not, if the Company had been left in possession of the undertaking, have been carried out all at once. Probably they would have been spread over two or three years; and this would have enabled the Company to raise the capital and pay the dividends upon it without depriving the present shareholders of any of their profits. There were two other points which were of very considerable importance for the purpose of showing that the revenue was a perfectly safe one. Firstly, the Company were not

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charging their full rates; and, secondly, not only was the number of houses increasing, but the assessment of each individual house was being raised. No doubt, the Arbitrators had been struck with the fact that the capital of the Company—£20,000 in shares, and £5000 loan—was exceedingly low; but this was owing to the economical way in which everything had been done. The result of this was that the District Council would get a concern which was rapidly increasing, and which would still more rapidly increase, in value; and though there was this great prospective value, they did not have to pay for it, because the Company could not receive more than the equivalent of their maximum dividends. No matter how much the Company went on earning, they could not divide more than this; and therefore the Council would receive all the surplus revenue without really having to pay for it. He thought, in preparing the award, it would be desirable for the Arbitrators to deal with the question of cost which the Company had incurred in constructing the Metton works. The arrangement was that the Company were to find the capital, and the Council were to refund the amount *plus* 5 per cent. interest. The Company would hand over the undertaking on Oct. 1, after which date the Council would have to find all money required.

Mr. JOHNSON pointed out, on the question of the back dividends, that there was the reserve fund of £1276, which the Company would retain under the arbitration, to be taken into account. This would, of course, go in reduction of the arrears of dividends, making the present amount £9200 odd.

THE AWARD.

The award was signed by the Arbitrators, and dated Sept. 25. It stated that the amount to be paid by the Council to the Company for the purchase of the undertaking was £59,302, together with £7072 9s. 2d., the amount borrowed (with interest at 5 per cent.) for carrying out the new works at Metton, as agreed between the parties, subject to the Council being credited with any balance that remained unexpended on Sept. 30.

Retford Water Supply.—The twenty-first annual report on the Retford Corporation water undertaking shows that the water-rates for the year amounted to £2587, compared with £2697 in the preceding year, the decreases being due to the Great Central Railway Company not taking so much water. The net surplus is £458 19s. 4d., compared with £413 16s. 1d. in the preceding year; and the amount standing to the credit of the profit and loss account is £1422 19s. The Water Committee report that the sinking of the two additional borings and the extension of the adit have been successfully carried out; the result being that they have obtained a considerably increased volume of water. They advise that an additional and larger pumping-engine should be put down at a cost of about £2500.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The sequel to the opening of the new gas-works at Granton has come sooner than I expected. To-day, at noon, the Leith works were closed. Most of the men, it is stated, have been translated to Granton, so there will be little grievance on that score. The closing of the Leith works at so early a date is the best testimony that can be had to the entire satisfaction which there is with the working at Granton. It may be taken for granted that, had there been any reason for doubting the capability of the Granton works, those in Leith would have been kept going a little longer; but nothing of the kind has been necessary.

The municipal elections this week have produced some results which will be far-reaching. Though none of them can be said to have a very close connection with gas affairs, yet, in the result, these are certain to be affected, by-and-bye, if the pendulum continues on its present swing. The greatest of all the changes which the election has brought about is the rejection of Lord Provost Chisholm, of Glasgow,* by a constituency he has represented for many years. Dr. Chisholm committed a blunder when he sought to return to the Town Council. When a man has been Chief Magistrate, the reasons should be very strong indeed which should induce him to continue in the Council as an ordinary member; for his presence is certain to be embarrassing to his successor. There was nothing which called for Dr. Chisholm's return to the Council, except it were his eagerness to promote schemes for social amelioration. He has been in the forefront of such movements for many years; and it is understood that he has higher ambitions in the same direction. These two factors have worked his ruin—municipally. Some objected, on principle, to his going back to the Council; and others did not like his great aspirations. He has been beaten by an unknown youth; but it would be folly to look upon the event as an approval of the youth's public policy. It is almost a certainty that he will soon be forgotten, and that Dr. Chisholm's influence will continue to be felt in the community. The lesson, apart from the personal one of a Lord Provost returning to the Council, is manifestly that plans for reform ought not to be rushed. Great schemes of amelioration cannot be thrust upon unwilling communities. The next notable instance is to be found in Aberdeen, where a general fight took place over the question of who was to be Lord Provost. That was on the face of the conflict. The real question was as to which party was to rule the affairs of the city—the party of use and wont, or the party which style themselves Progressives. The Progressives have won most decisively, and are in the heyday of elation—a state of mind to which they are entitled, for the time being. The biggest man to fall was Treasurer Bisset, a gentleman who was returned to the Town Council years ago as a working-class representative, but who is not now so

* Dr. Chisholm has since been created a baronet.—ED. J. G. L.

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BELLEVILLE	250,000
OTTAWA (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000
ST. CATHERINES (Remodelled)	250,000
KINGSTON, PA.	125,000
PETERBOROUGH, ONT.	250,000
WILKESBARRE, PA.	750,000
ST. CATHERINES (Second Contract)	250,000
BUFFALO, N.Y.	2,000,000
WINNIPEG, MAN.	500,000
COLCHESTER (Second Contract)	300,000

	Cubic Feet Daily.
YORK	750,000
ROCHESTER	500,000
KINGSTON, ONT.	300,000
CRYSTAL PALACE DISTRICT	2,000,000
DULUTH, MINN.	300,000
CATERHAM	150,000
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popular with them as he was then. He was beaten upon the question of sub-contracting; and the gentleman whom he was to support for the provostship has since Tuesday resigned his office as councillor. Both Mr. Bisset and his candidate for the provostship have been supplying large quantities of material—the one iron, the other cement—to contractors for municipal work. The terms of their oath forbade them contracting themselves, but they believed they were within the law in sub-contracting. Perhaps they were, though I cannot see how they could escape the general rule that the greater includes the less, and that when they were excluded from contracting they should not have understood that it was not open to them to sub-contract. But whether their conduct were legal or not, the ratepayers have shown that they will have no such dealing on the part of their representatives. Here the lesson is that there must be no suspicion attaching to the doings of public men. The Aberdeen instance is more pronounced than the Glasgow one. In Glasgow the champion fell because of side issues; but in both cities it is the democratic spirit which has prevailed, and in Aberdeen the victory of the party is associated with the cry for purity of public life. Of course, it does not follow—it never does—that one party will be at all times purer than another. But the fact is unmistakable that the humbler classes are beginning to be more aggressive at the polls; and it may be taken to be as certain as night following day that their growth in power will not be without its effect upon public life.

The Town Council of Falkirk had a discussion last night upon the question of the proposed new gas-works for the town. It arose over the appointment of a Convener for the Gas-Works Committee. This office has been held by Mr. H. Russe'l for two years; and he was nominated for re-election. There is a minority in the Council who are opposed to the erection of new gas-works; and they nominated Bailie Russell for the post. In the course of the discussion, Bailie Russell said he was not very particular how the vote went; but he had decidedly been displeased for some time past in connection with the negotiations for the gas-works. His first reason was that when business was coming before the Committee the old constitutional principle of bringing it before the Works Committee for discussion, and then before the Council, had been departed from; and now the Finance Committee and the Works Committee were called together, and asked at times to decide very important matters right away, which became the opinion of the whole Council. He was entirely opposed to this, because he believed they were the better for having two or three days to think over things, and they could not have this by the two Committees meeting together. It had been stated that they had practically committed themselves to Thornhill; but he could not agree to that. It was far better to bear the ills they had than fly to others that they knew not of. He was quite prepared to do all he possibly could to delay the gas-works. He wanted them delayed; and this was the principal reason for his allowing himself to be nominated. Mr. Russell asked if it were not a fact that eighteen months ago the Town Council, he thought unanimously, agreed to abide by the last report. His instructions from the Council at that time were to enter into negotiations with the Railway Company to see what could be done in the way of railway facilities. He brought forward no policy. He simply endeavoured to the best of his ability—probably with no very great success—to carry out the instructions he then had from the Council; and up to this time he had never advocated anything in the way of a policy. He had maintained all along that new gas-works would be required before they could possibly have them erected. I was said they had not sufficient information. He thought he could give information, going back to the time when Parkhouse was first purchased, to show that the then Town Council, of whom a large number were present that night, condemned the Parkhouse site in language much stronger than he had ever heard since that time, or hoped to hear. Not only so, but gentlemen sitting round that table, a number of whom were then in the Council, unanimously appointed a Committee to look out for another site altogether. They were advised, in the words of the then Convener, that it would be practically a godsend if they were able to tide over for a couple of years. Since that time the output of the gas-works had considerably more than doubled. It had been suggested that they should have further expert opinion; but they had already had the opinion of four or five experts, and without a single exception they had condemned the Parkhouse site out and out. He thought the expert opinion that was obtained by the Town Council when they purchased this site told them distinctly, in language stronger than any one who had reported on it since, that it would be the height of extreme folly to erect gas-works there. When he was appointed Convener two years ago, the first thing he did was to call upon the Town Clerk to produce all the facts he had dealing with that site. These were produced, printed, and each member was furnished with a copy; and the majority of the Council at that time appointed a man of their own choice for the purpose of carrying the Parkhouse site if possible. Since the opinion was obtained which told them distinctly that Parkhouse was not a place for gas-works, and recommended that they should go to Thornhill if railway facilities could be secured, he had done nothing but try to get these facilities. In the end, Mr. H. Russell was appointed by the casting vote of Provost Weir.

There was a breakdown of the electric light in Edinburgh on Thursday evening, which was the occasion of much inconvenience to consumers. The cause was a short-circuit in one of the mains. The difficulty which the officials felt was in locating the fault. The light did not go out altogether, but was reduced to a dull glow which gave no illumination.

Acetylene gas for town supplies has not been very generally adopted, and where it has been it has not proved a conspicuous success. It was not long adopted at Cowdenbeath when it had to be given up, because the people objected to its cost. I think it is still in use in Portsoy; but little is heard of it—at least, in its favour. It has been adopted at West Linton, a pleasant little town on the south side of the Pentland Hills, where there was a coal-gas works on a small scale—very small,

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LONDON & EXETER.

the annual output being only about 200,000 cubic feet. In a local newspaper, there is a standing advertisement which states that, where coal gas exceeds 3s. 6d. per 1000 cubic feet in price, acetylene gas can compete with it. This doubtless led the Gas Company at West Linton to give up making coal gas, the price of which was 10s. per 1000 cubic feet, and to substitute acetylene gas for it. I do not know how the lighting is appreciated; but in this week's "Peebleshire Advertiser" there is a letter from a visitor who complains that the price of 6s. which was promised as the charge for acetylene gas works out to £3 per 1000 cubic feet. He wants someone to let him know what the 6s. was to be for—100 cubic feet or 1000 cubic feet. They are told that the meters register 100 cubic feet for 1000 cubic feet; and he calculates that this brings out an equivalent of about £3 18s. for coal gas. The writer says he was amazed when his first month's bill came in. It is probable that the people are not educated to the use of the new gas, and that, not having proper fittings for its consumption, they are burning too much of it; but this is a matter upon which the Gas Company should put them right. West Linton is very largely patronized by visitors; and it behoves the Company to see that nothing is done, or omitted to be done, by them which would drive people away or prevent their coming. The writer insinuates that someone is grasping a profit in the business. That is from the point of view of the consumer. I daresay, if the truth were known, the Gas Company are finding it quite the opposite. Changes of this sort are not easily carried out. When they are to be made, they should be well considered beforehand; and in practice it ought to be seen that consumers are not allowed to run up bills of greater amount than they did before. Otherwise, if that cannot be done, the new arrangement should be given up, and something else resorted to.

Addressing the electors in Hamilton last Monday week, Bailie MacHale, the Convener of the Gas Committee, said that in 1895 the income of the Gas Department was £11,108, and last year it had risen to £23,730—more than double. He did not wish them, however, to imagine that there had been all this increase. There were two circumstances that had contributed to it—viz., last year was one of fourteen months for the department, and then the price of gas was 2s. 6d. per 1000 cubic feet as compared with 2s. 1d. in 1895, which accounted for a considerable portion of the great increase. There was one matter that afforded the Committee much pleasure. In the past, the leakage of gas had been very considerable; and this waste had been greatly decreased. The Manager (Mr. Ballantyne) had given the matter special attention, and in this and other ways he had proved an excellent official. A good deal had been said about the indebtedness of the burgh, which was stated to be hopelessly sinking into debt. Well, that did not apply to the gas-works. The plant there was valued at £47,945; and he had no hesitation in saying that the works were worth more than double that amount. After the present extensions were completed, he thought it would be well to have the works valued by an independent official, so as to know exactly how they stood; and he would be very much surprised if this asset was not placed at a very high figure. During all the time he had been Convener, they had been adding to the capital expenditure. This had been necessary; but he would be inclined, after the present extensions were completed, to say they had had enough—at least, until they got another Convener. During the last six or seven years, the works had been practically reconstructed. As to the manufacture of sulphate of ammonia, the Manager's estimate for the coming year from this source was £1000 profit; and he (Bailie MacHale) would be surprised if this sum was not exceeded. That was practically found money, and something they never anticipated. On a former occasion he had suggested that, instead of this profit going into the funds of the gas-works, it might be devoted to some purpose of practical utility in the burgh. At the same time, he still believed that the gas-works should be run for the benefit of those who used them. This money, however, might be devoted to the erection of a new Town Hall and Municipal Chambers worthy of the town. If they had a profit of £1000 at their disposal, such a sum would go very far to pay any expense likely to be incurred in the erection of such chambers. As to the price of gas, appearances were such as to permit of a substantial reduction being made, and still allow sufficient for depreciation.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Nov.* 8.

Sulphate of Ammonia.

Throughout the week the demand has been somewhat slack, and parcels offered have only been disposed of at a decline. There are November contracts to cover; but operators seem disposed to wait for still lower prices, and consumers' immediate requirements have not been sufficient to check the downward tendency. The closing quotations are £11 1cs. per ton f.o.b. Hull and Leith, and £11 12s. 6d. per ton f.o.b. Liverpool. There has been fair inquiry for November and December; but buyers can only be tempted by a discount on spot prices. For delivery further ahead, the views of makers and consumers are becoming still more divergent; and although "bears" have become more venturesome, even their quotations have not induced much business.

Nitrate of Soda.

This is steady on spot at 8s. 10½d. to 9s. per cwt, according to quality; but interest in the forward position has slackened, and values are scarcely maintained.

LONDON, *Nov.* 8.

Tar Products.

The markets remain in about the same position as last reported; the demand for pitch being very strong, especially for prompt delivery in London. It is said that business has been done all over 1904 in the north of England; but the price does not appear to have transpired. In anthracene there is a little more doing, but only in "A" qualities of

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MAXIM PATENT CARBURETTOR
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PREVENTS NAPHTHALENE DEPOSITS.
OVER 100 MAXIM PATENT CARBURETTORS HAVE NOW BEEN FIXED.
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The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.
Dealers in Benzol, Carburine, and all other Naphthas and Oils suitable for the Enrichment or Production of Gas.
For Prices and full Particulars, apply to
THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,
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high percentage. Crude carbolic continues firm. A large business has been done in 60's at 1s. 8½d. to 1s. 9d., November shipment; but for forward delivery makers do not care to offer. Crystals are quiet. Makers quote 5¼d. for 39-40's, and a little business is reported in 34-35's at under 5d. In Benzol the demand is improving, and it would appear that more is now being consumed for enriching gas. There are sellers of 50 to 90 per cent. at 8½d. for November-December; but there does not appear to be any quantity of 90 per cent. offering. The inquiry for forward delivery continues good; but makers do not care to sell over next year, except at an increased price. Creosote continues to improve, and prices are decidedly firmer.

The average values during the week were: Tar, 19s. 6d. to 25s. Pitch, London, 54s. 6d. to 56s.; east coast, 52s. 6d. to 53s. 6d.; west coast, 50s. to 52s. Benzol, 90 per cent., 8⅛d. to 8¼d.; 50-90 per cent., 7⅞d. to 8¼d. Toluol, 6½d to 7d. Crude naphtha, 2¾d. to 3d.; solvent naphtha, 8d. to 9d.; heavy naphtha, 8d. to 10d. Creosote, London, 1⅞d.; North, 1⅞d. to 1⅝d. Heavy oils, 2d. Carbolic acid, 60 per cent., 1s. 8½d. to 1s. 9d. Naphthalene, 40s. to 55s.; salts, 23s. 6d. to 26s. Anthracene, "A," 1½d. to 1¾d.; "B," 1d. nominal.

Sulphate of Ammonia.

The market continues very quiet; and there is scarcely any business to report. The Gaslight and Coke Company are not offering for November-December. Their nominal quotation, however, is £11 13s. 9d.; but probably they would sell at £11 12s. 6d. for December only. Another London Gas Company have sold a considerable quantity at £11 10s. for November shipment; but now ask £11 13s. 9d. In Hull, business has been done at £11 8s. 9d. for prompt shipment, but only to a limited extent—makers as a rule asking £11 10s. There is no business to report from Leith; but there are sellers at £11 10s. prompt. In Liverpool, the demand continues steady. It is difficult to fix the exact quotation, as several small sales have been made at very good prices.

COAL TRADE REPORTS.

Lancashire Coal Trade.

The definite move that has now been made by the Miners' Federation, with a view of bringing about a revision of the present rate of wages, necessarily has some disturbing influence in the coal trade of this district. There would seem to be very little probability of miners being able to convince either the Conciliation Board or the Arbitrator that the present condition of trade entitles them to any advance upon the rate of wages now being paid. The most probable effect of the movement will be to make colliery owners very chary about putting up prices, which may only represent a temporary sort of advance, and will serve to keep the market on a more level basis than might otherwise have been the case. So far as the general trade in round coal is concerned, the demand for house-fire qualities has fallen off very considerably; and although pits are kept on full time, supplies are generally ample to meet requirements. In many quarters there are anticipations that pits may have to go on less time, or else a portion of the output go into stock. The lower descriptions of round coal continue in very indifferent demand for ironmaking, steel, and general manufacturing purposes; and it is only with a good deal of this kind of fuel going away recently for house-fire consumption that there are no large surplus supplies on the market. Taking prices for round coal all through, they are steady at late rates, averaging about 15s. to 16s. per ton for best house coal, 13s. 6d. to 14s. for seconds, 10s. 6d. to 11s. 6d. for common house coal, and 8s. 6d. to 9s. for steam and forge coals at the pit. In engine classes of fuel, supplies continue plentiful on the market; and even in the better sorts the output at many collieries is in excess of requirements. From outside districts—Derbyshire and Yorkshire especially—slack has been pushed for sale here and there at low competing prices, with special quotations for clearance sales in anything like quantities. This gives a weak, irregular tone to the market; but the general quoted rates at Lancashire collieries remain practically unchanged at about 6s. 6d. to 7s. for best slack, 5s. 6d. to 6s. for medium, and 4s. 6d. to 5s. for commoner sorts. The shipping trade is moderate, with prices for steam coals not averaging more than 10s. 6d. to 11s. per ton delivered at the ports on the Mersey. Brisk inquiry is still reported by Lancashire makers for all descriptions of coke, with prices very firm at full rates; but in the Yorkshire district there is a lessening demand, and prices are not quite so strong at recent maximum quotations.

Northern Coal Trade.

There is now ease in the coal trade of the North; the demand having lessened in some directions, while mild weather has kept down the local demand to some extent. Best Northumbrian steam coals are quieter at from 11s. to 11s. 6d. per ton f.o.b., second-class steams are dull at 10s. to 10s. 6d., and the demand seems also less for steam smalls at from 5s. 3d. to 6s. per ton. There is rather more steadiness in the Durham coal trade, the request for it being more of a winter one. In the gas coal trade, the demand has increased on the long contracts, and is now about at the highest point of the year. Durham gas coals vary from about 9s. to 10s. per ton f.o.b., according to quality, for occasional cargoes. Gas coke is still rather scarce, though the production is full; and the price varies from 12s. 6d. to 13s. per ton f.o.b. in the Tyne.

Scotch Coal Trade.

Trade is active, which is accounted for by the demand from France and the near approach of the close of the Baltic season. There is a specially strong demand for splint; but all varieties are moving off freely. The prices quoted are: Main 9s. to 9s. 3d. per ton f.o.b. Glasgow, ell 10s. 3d. to 11s. 3d., and splint 10s. 6d. to 10s. 9d. The shipments for the week amounted to 256,514 tons—a decrease of 12,469 tons upon the preceding week, but an increase of 41,059 tons upon the corresponding week of last year. For the year to date, the total shipments have been 9,191,123 tons—an increase of 843,714 tons upon the same period of last year.

"Eureka"

Gas-Fires.

The most admirably suited for **Hiring** purposes.

Winchcombe in Darkness.—The town of Winchcombe was in darkness on Saturday night, in consequence of a new set of regenerative retorts, which the Gas Company have put in, not producing gas so quickly as had been expected. The old retorts were not in a condition to turn out sufficient gas to enable any reserve to be made. The hydraulic main from them had to be disconnected to allow a new one to be put on; and the new furnaces not being sufficiently hot, there was not a foot of gas available.

Incandescent Gas Lighting at Perth (W.A.).—Mr. W. G. Quicke, who left England early last year to take up the position of Manager of the Gas Department of the Perth (W.A.) Gas and Electric Light Company, in the course of a letter received last week, mentions the rapid progress which is being made there with incandescent gas lighting; his staff having recently been well employed displacing electric installations. He has bought up all the available Welsbach burners, &c., to be had in Perth at present, but nevertheless has nearly run out of stock. Mr. Quicke says he is fighting for the control and extension of street lighting; but progress is very slow, though prospectively there is some chance of securing a portion on new lines proposed by himself.

Colonial Gas Association, Limited.—In their annual report, the Directors of this Company state that there has been an average increase of above 7 per cent. in the consumption of gas during the past year, which increase the Managing-Director (Mr. George Swinburne) feels confident would have been more, had not the country suffered from such a continuous drought. The accounts show a profit of £4927, from which £1267 was paid to the shareholders in April last as an interim dividend. After providing for interest on debentures, &c., to June 30, there remains a balance (including the amount brought forward from June 30, 1901) of £2703. The Directors now recommend a dividend, for the second half of the year, at the rate of 5 per cent. per annum, free of income-tax (making 4 per cent. for the year), which will absorb £2114, and leave a balance of £589 4s. to be carried forward.

Southampton Gas Company.—The Directors reported that in the six months ending June 30 there was an increase of about 23 million cubic feet of gas sold, compared with the corresponding period of 1901; and the receipts were £3469 15s. 2d. more. The number of consumers on the prepayment system is 6900, nearly all of whom use cookers. The payments for rates and taxes for the entire year to the above-named date amounted to the very large sum of £5173 13s. 10d., equal to a charge of 2¾d. per 1000 cubic feet of gas contributed by the consumers to this account. The expenditure during the past half year for coal and oil was lower by £3209 14s. 11d. than in the June half of 1901. The sum available for distribution was £12,794 2s. 9d.; and the Directors recommended the payment of the maximum dividend of 5 per cent. per annum (less income-tax), amounting to £10,520 13s. 8d. for the half year on the ordinary stock. This would leave £2273 9s. 1d. to be carried forward. The report came before the shareholders at their half-yearly general meeting last Wednesday, and was unanimously adopted.

Hampton Court Gas Company and their Rates.—An agreement has been come to between the District Council and Overseers of East Molesey and the Hampton Court Gas Company, with regard to the case which was heard at Kingston last month (*ante*, p. 1152). The arrangement is that the Company shall receive a sum of £75 from the Council and a like amount from the Overseers in settlement of their claim for overpaid rates. The matter is thus at an end, and the Company have been fully justified in the stand they made.

A Power Gas Installation in Birmingham.—The first installation of power gas in Birmingham is approaching completion at the works of Messrs. J. & E. Wright, where plant has been laid down for the production of gas, from cheap bituminous slack, for the driving of gas-engines in 100 horse power units. The system is an adaptation by Messrs. Crossley Bros. of the Mond process, simplified by the neglect of bye-products, and will furnish 500-horse power. It is intended to displace steam power entirely for the driving of the firm's machinery. The engines are in various parts of the works where they will be of most use; and some of them will be over a quarter-of-a-mile from the gas-generator. It is anticipated that the coal consumption will be reduced to one-quarter the present amount, in addition to which the exhaust from the engines will be used to heat the workshops.

Sales of Shares.—Mr. Alfred Richards sold at the Mart, Tokenhouse Yard, E.C., last Tuesday, by order of the Directors of the Barnet District Gas and Water Company, a new issue of £5000 of "D" 7 per cent. stock (last dividend at the rate of £4 18s. per cent. per annum), at prices ranging from £104 to £110 per £100 of stock. On the same occasion, he carried out instructions received from executors and offered £3150 of ordinary 5 per cent. stock of the Crystal Palace District Gas Company, the last dividend on which was at the rate of £5 6s. 8d. per cent. per annum, which was sold at from £116 to £118 per £100 of stock. On the following day, Messrs. Fox and Bousfield sold portions of King's shares in the New River Company at the rate of from £90,000 to £84,000 per share; also some 3 per cent. debenture stock at 97 per cent., and some £100 new shares at £385 and £390 each *ex div.* A sale of £7000 of ordinary 5 per cent. stock of the Chester United Gas Company took place a few days ago in that city. It was offered by Messrs. Churton, Elphick, and Co., in lots of £100, and they fetched from £113 to £115 apiece. Last Thursday, £6500 of consolidated ordinary stock of the Kingston-upon-Thames Gas Company was sold by Messrs. Nightingale, Phillips, and Page in £100 and £50 lots—the former at £115, and the latter at £57 10s. each. Acting on the instructions of the Directors of the Croydon Gas Company, Messrs. Hooker and Webb last Thursday offered for sale by public auction, at the Greyhound Hotel, £2500 of 5 per cent. perpetual debenture stock, and £5000 of consolidated "C" ordinary stock, of the Company, the latter paying 9 per cent. It was stated that the reserve and insurance funds of the Company now amount to £44,534. The debenture stock fetched prices averaging £132 6s. 9d., and the "C" stock £194 4s. 4d. per £100 of stock.

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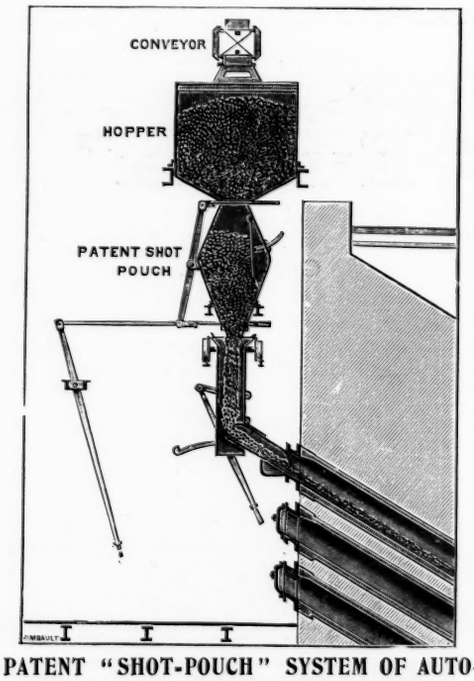

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Our Installations with "Eclectic" Furnaces are at work all over the World.

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Increased Gas Storage for Yeovil.—A Local Government Board inquiry was held by Mr. J. C. Pattinger at Yeovil last Thursday, into an application by the Corporation for sanction to the borrowing of £7000 for the erection of a new holder. The Gas Manager (Mr. E. Howell) said that £10 per ton was put down for laying the pipes for connection with the present works, and 8s. per cubic foot for the concrete for the tank and the foundation for the retaining wall. The Inspector remarked that he had submitted these two estimates to the Chief Engineer of the Local Government Board; and he considered them altogether too low. Mr. Howell said he was quite prepared to undertake the work on these terms; and a Yeovil builder was willing to do it for less. He added that the increase in consumption since the works were taken over by the Corporation three years ago had been 28 per cent. The period for which the loan was asked was 40 years.

The Cost of Assessment Appeals.—Complaint was made at the meeting of the Dawlish Urban District Council last Thursday of the expense to which the town had been put through the proceedings of the St. Thomas Union Assessment Committee, in reference to the assessment of the water-works. Mr. Bayldon said that the rating of the water-works was raised from £26 to £500. As the result, the Council were put to the expense of employing an expert and obtaining legal advice; but when the matter was ready to come before Quarter Sessions, they were informed that it was to be referred to the arbitration of a firm under whose advice the Dawlish Council had been acting. Through the action of the Assessment Committee, £115 had been spent unnecessarily. Mr. Tupper thought that some effective representations should be made on the subject. Mr. Bayldon feared that they could not appeal to the Local Government Board under the circumstances, through it was undoubtedly a very hard case for a small place like Dawlish.

Plymouth Corporation and the Protection of the Leat.—At a meeting of the Devonport Town Council on Thursday last, the Gas Committee reported that correspondence had passed between them and the Plymouth Corporation as to an alleged trespass by the Committee in laying a gas-main in Tavistock Road under the disused leat of the Plymouth Corporation. The Gas Manager (Mr. Sidney E. Stevenson) reported that, on his proceeding to lay the main, Mr. Howorth, the Water Engineer of the Corporation, had stated that he was instructed to prevent the execution of the work, by force if necessary; and that, in order to prevent a breach of the peace, the laying of the main was deferred. Since this occurrence a writ had been served by the Plymouth Corporation, claiming an injunction to restrain Devonport from trespassing on the property of the Corporation by laying the main through or under the leat. The Town Clerk said that the Plymouth Corporation had been supplied with a copy of the plan, which showed that it was proposed to lay the main a foot below the bottom of the leat. The Gas Committee instructed the Town Clerk to enter an appearance to the writ, but left it the new Committee to be appointed next week to decide whether the action shall be defended.

Halfpennies in Local Authorities' Accounts.—At the recent audit of the accounts of the Spalding Urban District Council, the Local Government Board Auditor and five clerks were engaged for an hour in discussing how a halfpenny should be dealt with. The banks refuse to take halfpennies, and the Auditor contended that they should accordingly be brought forward. His predecessor, however, had held otherwise, and had marked out the halfpenny balance. No decision was arrived at, and the audit had to be adjourned. Our contemporary the "Financial News," referring to the matter, asks: "Where do the ratepayers come in?"

Devonport Corporation Gas-Works.—A report submitted to the Devonport Town Council on Thursday last by the Gas Manager (Mr. Sidney E. Stevenson) showed that the output of gas in September was 11·74 per cent. more than in the corresponding month of last year. Mr. Hornbrook, the Chairman of the Committee, said that everything was going on swimmingly. They were making more gas and better gas than the Company did, besides effecting a considerable saving in wages. To those who predicted a great loss on the undertaking, he would reply, "Wait." Mr. Rendle said he did not believe the gas-works would be a success, in spite of what the Chairman stated. Some discussion took place on a resolution of the Gas Committee not to continue the subscription of £10 a year to the local hospital. The Corporation had offered a substantial contribution to the hospital on the condition that it should have representation on the Committee of the institution; but this was not accepted. The action of the Gas Committee was confirmed, though some members strongly protested that it would be a disgrace to the Corporation if an accident should occur to necessitate some of their employees going to the hospital.

Bradford-on-Avon Corporation and the Gas Supply.—Lord Edmund Fitzmaurice, M.P., who is the Vice-Chairman of the Bradford-on-Avon Town Council, has for some time interested himself in the gas supply; and on Wednesday, through his Lordship's instrumentality, a special meeting of the Council was held to consider the desirability of acquiring by purchase the Gas Company's undertaking. At the last moment, however, he found himself unable to get away from his parliamentary duties; and in telegraphing an apology for his non-attendance, he expressed himself in favour of purchase. The Council discussed the question at great length, and it was pointed out that the cost of opposing the Company's Bill of this session equalled a rate of 1d. in the pound. Replying to the Chairman (Mr. E. Pinckney), the Clerk stated that if the Council decided to take over the works at the present time the Company could not oppose them; and consequently the expense of getting an Act would not exceed £600. If, on the other hand, they decided to acquire the undertaking after the time allowed them had expired, the Company could do so. It was thought that the cost of the concern would be upwards of £20,000. Several members felt that, as the town was now heavily rated, it should not be called upon to incur additional burdens. Ultimately, a proposition to employ an expert to go into the matter was defeated, and no further action was taken.

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Size—3 ft. 6 in. by 2 ft. 4½ in. by 1 ft. 10½ in. PRICE £12.

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could be desired, as far as appearances indicate. This characteristic has much to recommend it, for there is no knowing what

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Among the awards made for goods shown at the Health Exhibition held in connection with the recent Congress of the Sanitary Institute in Manchester, we notice the following: Silver medals to the Cannon Iron Foundries, Limited, Messrs. J. Defries and Sons, Limited, and Messrs. Mather and Platt, Limited; and bronze medals to Messrs. Ewart and Son, Limited, and Messrs. Fletcher, Russell, and Co., Limited.

The Potton Gas and Coke Company, Limited, has been registered with a capital of £1200, in 90 shares of £10 each and a like number of £3 6s. 8d. each, being a reincorporation, under the Companies Acts, of the Potton Gas and Coke Company, constituted by Deed of Settlement dated Nov. 2, 1853. The original undertaking was started to carry on in Potton, Bedfordshire, the business of a gas and coke company in all its branches. At the date of the conversion, 89 shares of £10 each and 73 shares of £3 6s. 8d. each had been taken up, and the full amount had been paid on all.

Messrs. D. Bruce Peebles and Co., of Edinburgh, have found it necessary, owing to considerable extension of the electrical engineering branch of their business, to separate it from the gas department. They have therefore taken 10 acres of land at Pilton, in the neighbourhood of the new gas-works at Granton, and have commenced the erection thereon of an establishment which will be completely equipped with the latest plant, to be operated by electricity. The new shops are expected to be ready about nine months hence. The removal of the electrical department will afford room for the further development of the gas branch of the business, which will be carried on at the old works at Bonnington. The firm are sending out two artistically got-up pamphlets, showing dynamos, motors, controllers, &c., and giving an illustrated description of electrical plant erected by them for supplying power at the Linwood Paper-Mills, Renfrewshire.

In consequence of an accident, the traffic on a portion of the Birmingham Canal Navigation Company's route has been stopped, and in addition the supply of water to keep up the levels has also been cut off. It therefore became necessary to immediately put in pumps to take the water back again from the lower to the upper levels. The Company, under these circumstances, approached Messrs. Joseph Evans and Sons, of Wolverhampton, who undertook to supply the necessary pumping-engines, and carried out the work in a very smart manner. The order was placed with them on the 27th ult. The first pump was despatched from the works on the following night, and the second two days later; while the whole of the installation, including boilers, pipes, &c., was completed and set to work by the 2nd inst., just in time to come into operation as the supply reservoir was exhausted—thus avoiding an entire stoppage of the traffic.

As will be seen by our advertisement columns to-day, the Directors of the Eastbourne Gas Company have decided to issue by tender 1300 additional "B" £10 shares. For several years past dividends at the rate of 11½ per cent. have been paid on shares of this class; and therefore the minimum price of £23 at which they will be issued shows a net dividend of 5 per cent. The rapid growth of Eastbourne has rendered necessary a large addition to the Company's works and the laying of many miles of new mains; and the additional capital is required to cover this expense.

In the "JOURNAL" for the 21st ult. (p. 1105), we recorded the acceptance by the Walsall Corporation of a proposal made to them by the British Cyanides Company, Limited, for taking out the cyanogen contained in the gas manufactured at their works, and converting it into sulphocyanide of potassium. We are informed that the scrubber-washers specially manufactured by Messrs. W. C. Holmes and Co., of Huddersfield, for this purpose have been selected, and the order placed with the firm for the supply of them, to deal with the whole of the gas for the several sections at the Walsall works.

It will be seen by an announcement which appears elsewhere that the Southwark and Vauxhall Water Company are inviting tenders for an issue of 3 per cent. debenture stock, authorized for carrying out intercommunication works under the provisions of the Metropolis Water Act, 1899. It will rank *pari passu* with their "B" stock; and the interest will be borne by the eight Metropolitan Water Companies in varying proportions. It is a trustee stock, and will be redeemable at par, at the option of the Company, 25 years from the date of issue. Noon next Tuesday is the limit of time for sending in tenders.

The English Acetylene Association have just issued a useful set of regulations governing the design, construction, and manipulation of generators, together with rules covering the sale of calcium carbide and the employment of purifying materials. The temperature of the gas on leaving the charge is not to exceed 100° C.; and the limit of pressure in any part of the generator is to be 20 inches, and that in the service-pipes within the house 5 inches, of water. The purifying materials are to remove phosphorus and sulphur compounds to a commercially satisfactory extent—*i.e.*, not to a greater degree than will allow easy detection of escaping gas through its odour. The material is not to yield any products capable of corroding the mains or fittings. The rules as to carbide specify that "standard" sized carbide (1 to 2·5 inch lumps) is to give 4·8 cubic feet of gas per pound, measured at 60° Fahr. and 30 inches of the barometer. Carbide evolving down to 4·2 cubic feet may be accepted at a *pro ratâ* reduction in price; but carbide yielding less than this quantity need not be taken. A latitude of 5 per cent. is allowed in analysis.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

SITUATIONS VACANT.

ENGINEER AND MANAGER. Beverley Gas Department. Nov. 19.
GAS-FITTER. No. 3944.
GAS-FITTERS. Richmond Gas Stove and Meter Company, Dublin.
INCANDESCENT LIGHTING ATTENDANT. Trowbridge Gas-Works.
NIGHT MAN FOR STOKING. Tenbury Gas-Works.
PREPAYMENT INSTALLATION ATTENDANT. No. 3942.
STOKERS. Leatherhead Gas-Works.
WATER INSPECTOR. Mansfield Corporation.
WORKING FOREMAN. No. 3926.
WORKING UNDER FOREMAN. Portishead Water Company.

SITUATIONS WANTED.

ASSISTANT OR CHIEF. No. 3940.
CARBONIZING FOREMAN. No. 3943.
GAS FITTING AND STOVE TRADE FOREMAN. No. 3945.
WORKING MANAGER OR FOREMAN. Burt, Glastonbury.

AGENT WANTED BY GERMAN MANUFACTURER. No. 3939.

GAS-WORKS FOR SALE.

ATTLEBOROUGH. Richards, London. Nov. 18.

JOURNAL VOLUMES FOR SALE.

1888 to 1900 (Bound). HOUSEMANN, Westminster.

MEETING OF COMPANY.

ORIENTAL GAS COMPANY. Nov. 19.

PLANT, &c. (Second-Hand), FOR SALE.

EXHAUSTER AND GASHOLDERS (various). Wright, London.
PURIFIERS, SCRUBBER-WASHERS, GASHOLDERS, &c. Firth Blakeley, Dewsbury.

PLANT, &c. (Second-Hand) WANTED.

RETORT MOUTHPIECES. Wright, London.

SALES OF STOCKS AND SHARES.

BRIGHTON AND HOVE GAS COMPANY. Nov. 25.
EASTBOURNE GAS COMPANY. Nov. 29.
ILFORD GAS COMPANY. Nov. 25.
LEA BRIDGE GAS COMPANY. Dec. 2.
NORTH MIDDLESEX GAS COMPANY. Nov. 18.
SOUTHWARK AND VAUXHALL WATER COMPANY. Nov. 18.
SUNBURY GAS COMPANY. Nov. 18.
WANDSWORTH AND PUTNEY GAS COMPANY. Nov. 18.

TENDERS FOR

AMMONIA WATER TANK.

MANCHESTER GAS DEPARTMENT. Tenders by Nov. 29.

FIRE-CLAY GOODS.

MANCHESTER GAS DEPARTMENT. Tenders by Nov. 28.

GASHOLDER, TELESCOPIC.

YEOVIL GAS DEPARTMENT. Tenders by Dec. 3.

GASHOLDER TANKS.

COVENTRY GAS DEPARTMENT (Concrete). Tenders by Nov. 22.
YEOVIL GAS DEPARTMENT (Steel). Tenders by Dec. 3.

INCLINED RETORT INSTALLATION.

LEEDS GAS DEPARTMENT. Tenders by Nov. 24.

IRONWORK FOR GASHOLDER TANKS.

COVENTRY GAS DEPARTMENT. Tenders by Nov. 22.

TAR.

CHRISTCHURCH GAS COMPANY. Tenders by Dec. 1.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

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